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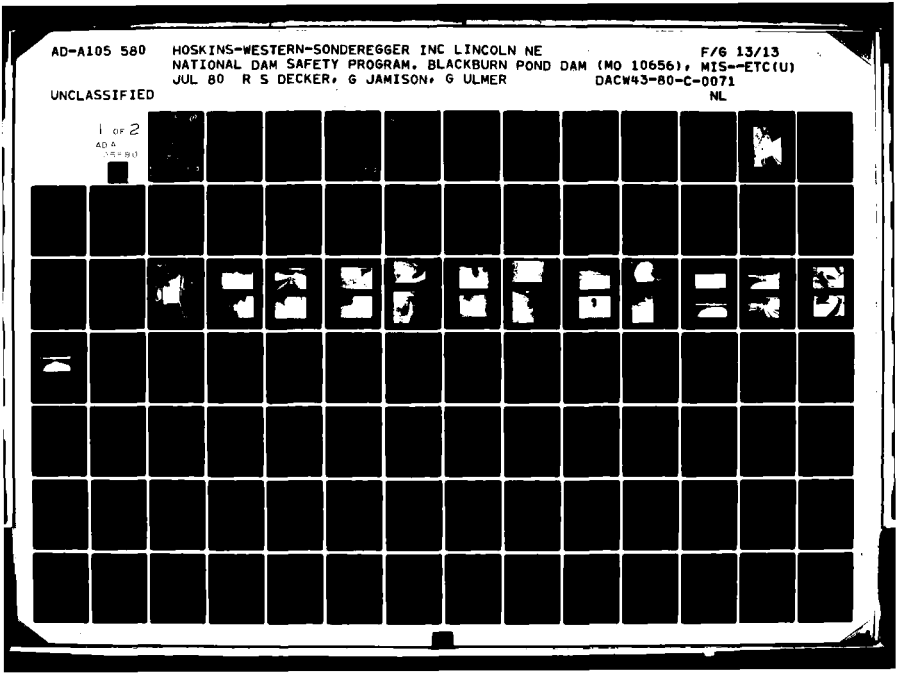

LEVEL II

MISSOURI - KANSAS CITY BASIN

AD A105580

BLACKBURN POND DAM

SALINE COUNTY, MISSOURI

MO. 10656

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A105 580
	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Blackburn Pond Dam (MO 10656) Saline County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Hoskins-Western-Sonderegger, Inc..	8. CONTRACT OR GRANT NUMBER(s) DACW43-80-C-0071
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	12. REPORT DATE July 1980
	13. NUMBER OF PAGES Approximately 70
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) National Dam Safety Program. Blackburn Pond Dam (MO 10656), Missouri - Kansas City Basin, Saline County, Missouri. Phase I Inspection Report.	15. SECURITY CLASS. (of this report) UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIB

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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BLACKBURN POND DAM
SALINE COUNTY, MISSOURI
MISSOURI IDENTIFICATION NO. MO 10656

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY
HOSKINS-WESTERN-SONDEREGGER, INC.
CONSULTING ENGINEERS
LINCOLN, NEBRASKA

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

JULY, 1980

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Blackburn Pond Dam - MO 10656

This report presents the results of field inspection and evaluation of the Blackburn Pond Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division

07 OCT 1980
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

08 OCT 1980
Date

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM
ASSESSMENT SUMMARY

Name of Dam	Blackburn Pond Dam
State Located	Missouri
County Located	Saline County
Stream	Tributary to East Fork Elm Branch
Date of Inspection	July 2, 1980

Blackburn Pond Dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. The purpose of the inspection was to make an assessment of the general conditions of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers.

Blackburn Pond Dam has a height of twenty-eight (28) feet and a storage capacity at the minimum top elevation of the dam of one hundred and eighteen (118) acre-feet. In accordance with the guidelines, a small size dam has a height greater than or equal to twenty-five (25) feet, but less than forty (40) feet; and a storage capacity greater than or equal to fifty (50) acre-feet, but less than one thousand (1,000) acre-feet. The size classification is determined by either the storage capacity or height, whichever gives the larger size category. Blackburn Pond Dam is classified as a small size dam.

In accordance with the guidelines and based on visual observation, the dam is classified as having a significant downstream hazard potential. Failure may damage isolated homes, secondary highways or minor railroads, or cause interruption of use or service of relatively important public utilities. The estimated damage zone extends approximately three (3) miles downstream of the dam. Within the damage zone are the Illinois Central Gulf Railway, a dwelling, a power line, and four (4) light duty roads.

Our inspection and evaluation indicates that the spillway meets the minimum criteria set forth in the recommended guidelines for a small dam having a significant hazard potential. Considering the volume of water impounded and the downstream hazards, the 100-year flood is the appropriate spillway design flood. The spillways will pass the 100-year flood (one percent probabilistic flood, a flood having a one percent chance of being exceeded in any year) without overtopping the dam. The spillways will pass 68% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

The following remedial measures and maintenance procedures are recommended:

a. Alternatives. Since the dam and spillway can accommodate at least 50 percent of the PMF, no alternative measures are required.

b. Operating and Maintenance Procedures.

(1) Trees should be removed from the embankment and measures taken to prevent their recurrence.

Large trees or trees with an extensive system of roots should be removed under the guidance of an engineer experienced in the design and construction of dams.

(2) The concrete in the spillway should be repaired.

(3) A program of regular inspection and maintenance should be established.

Rey S. Decker
E-3703

Gordon Jamison

Garold Ulmer
E-19246

H. P. Hoskins

Harold P. Hoskins, Chairman of the Board
Hoskins-Western-Sonderegger, Inc.
E-8696

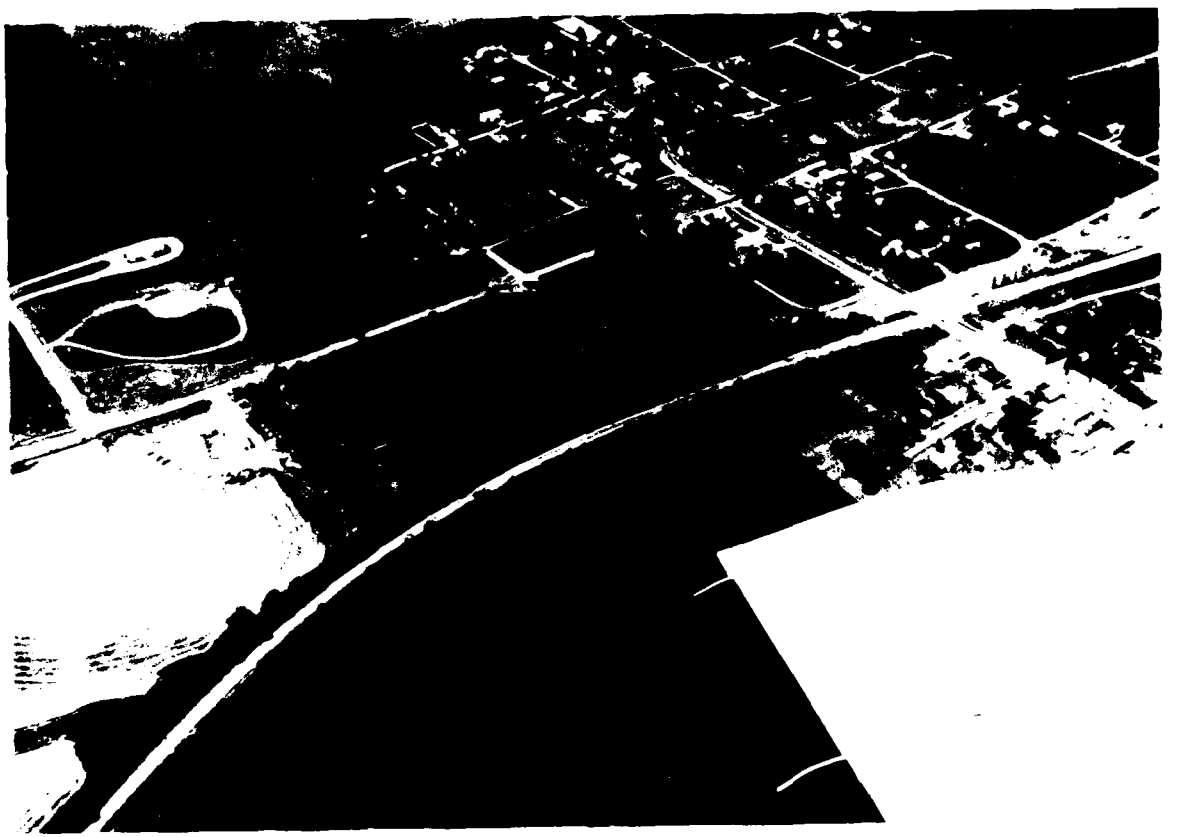


PHOTO NO. 1 - OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
BLACKBURN POND DAM - MO 10656
SALINE COUNTY, MISSOURI

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Blackburn Pond Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D to "Report of the Chief of Engineers on the National Program of Inspection of Dams," dated May, 1975, and published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an old railroad fill that was converted to an impounding dam by constructing a reinforced concrete riser onto the existing concrete culvert through the fill. The dam is about 1100 feet in length and approximately 28 feet in height. The maximum water storage at the minimum top elevation of the dam is 118 acre-feet. The dam is located in the gently rolling loess covered hills south of the Missouri River in the town of Blackburn, Missouri.

(2) The principal (and only) spillway is uncontrolled and consists of a 30' x 15' reinforced concrete drop inlet (riser) with a 30' parabolic weir crest connected to a concrete arch conduit passing through the embankment.

(3) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the extreme west central portion of Saline County, Missouri, within the town of Blackburn as shown on Plate A-2. The dam is shown on Plate A-1 in the SW¼ of Section 19, T50N, R23W.

c. Size Classification. Blackburn Pond Dam has a height of 28 feet and a storage capacity of 118 acre-feet. This dam is classified as a small size dam. A small size dam has a height greater than or equal to 25 feet, but less than 40 feet; and a storage capacity greater than or equal to 50 acre-feet, but less than 1,000 acre-feet. The size classification is determined by either the storage or height, whichever gives the larger size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph 1.1c above. Based on referenced guidelines and visual observation, this dam is in the Significant Hazard Classification. The estimated damage zone extends approximately three miles downstream of the dam. Within the damage zone are the Illinois Central Gulf Railway, a dwelling, a power line, and four light duty roads.

e. Ownership. The dam is owned by the Illinois Central Gulf Railroad, 233 North Michigan Ave., Chicago, Illinois, and is leased to the Blackburn Fishing Club, Blackburn, Missouri.

f. Purpose of Dam. The dam impounds a recreational lake covering about 9 acres.

g. Design and Construction History. No design or construction data were available. The following information was supplied by Mr. George Borchers, a resident of Blackburn. The railroad fill was constructed in the late 1800's or early 1900's. Drainage through the embankment was provided by means of a concrete arch culvert. In the early 1920's, a reinforced concrete riser and weir was constructed by hand mixed concrete brought in by wheelbarrows. This spillway was connected to the existing arch culvert. The reservoir would have filled after the construction of the spillway in the early 1920's.

h. Normal Operating Procedure. There are no operating procedures for this structure. The level of the lake is dependent upon precipitation, infiltration, evaporation, and the capacity of the uncontrolled spillway.

1.3 PERTINENT DATA

a. Drainage Area. 171 acres (0.27 square miles).

b. Discharge at Damsite.

(1) All discharges at the damsite are through an uncontrolled reinforced concrete drop inlet (riser) and weir and a concrete arch conduit which passes through the dam embankment.

(2) Estimated maximum flood - unknown.

(3) The spillway capacity varies from 0 c.f.s. at elevation 779.1 feet (weir crest) to 1,053 c.f.s. at minimum top of dam (elevation 785.4).

(4) Total spillway capacity at the minimum top of dam is 1,053 c.f.s. ±.

c. Elevations. (Feet above M.S.L.)

(1) Top of dam - 785.4 (minimum); 794.6 (maximum)

(2) Spillway crest - 779.1

(3) Normal pool - 779.1

(4) Observed pool - 777.7

(5) Maximum experienced pool - Unknown

(6) Streambed at centerline - 760 ±

(7) Maximum tailwater - Unknown

d. Reservoir. Length (feet) of pool.

(1) At spillway crest - 750 ±

(2) At top of dam (minimum) - 1,000 ±

e. Storage (Acre-feet).

(1) Top of dam (minimum) - 118 ±

(2) Spillway crest - 43 ±

(3) Normal pool - 43 ±

(4) Observed pool - 34 ±

(5) Maximum experienced pool - Unknown

f. Reservoir Surface (Acres).

(1) Top of dam (minimum) - 15 ±

(2) Spillway crest - 9 ±

(3) Normal pool - 9 ±

(4) Observed pool - 8 ±

(5) Maximum experienced pool - Unknown

g. Dam.

(1) Type - earth embankment constructed for railroad grade

(2) Length - 1100 feet ±

(3) Height - 28 feet ±

(4) Top width - 16 feet ±

(5) Side slopes.

(a) Downstream - 1V on 2.3H (measured)

(b) Upstream - 1V on 1.9H (measured from crest to bottom of ballast)
1V on 1.2H (measured on exposed face from bottom of ballast to water surface)

(6) Zoning - Unknown

(7) Impervious core - Unknown

(8) Cutoff - Unknown

(9) Grout curtain - Unknown

(10) Wave protection - None

(11) Drains - None

h. Diversion Channel and Regulating Tunnel. None

i. Spillway.

(1) Principal (and only)

(a) Type - an uncontrolled, reinforced concrete drop inlet (riser) approximately 30 feet long and 15 feet wide with a parabolic weir crest approximately 30 feet long and 3.5 feet wide connected to a concrete arch conduit 8 feet wide and a height varying from 4.8 feet at the inlet to 6.5 feet at the outlet.

(b) Crest elevation (weir) - 779.1

Invert elevation (conduit) - 764.2

Outlet elevation (conduit) - 761.4

(c) Conduit length - 56.5 feet

(d) Downstream (Exit) Channel - Downstream channel is clean, stable and uniform and has an excellent vegetative cover. The slope of the exit channel is unknown.

j. Regulating Outlets. None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available for this dam.

2.2 CONSTRUCTION

No construction data were available. It was reported by Mr. George Borchers that the railroad grade embankment was converted to an impounding dam in the early 1920's by constructing a reinforced concrete riser as a spillway.

2.3 OPERATION

No data were available on spillway operation.

2.4 EVALUATION

a. Availability. No data were available.

b. Adequacy. The field surveys and visual observation presented herein are considered adequate to support the conclusion of this report. Seepage and stability analyses were not available. The lack of evidence of seepage along the downstream toe, the long service of the dam as the roadbed for the Illinois Gulf Central Railway, and the uniform profile of the crest would indicate that seepage is not a problem and that the embankment is stable.

c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the Blackburn Pond Dam was made on July 2, 1980. Engineers from Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska making the inspection were: R.S. Decker, Geotechnical; Gordon Jamison and Garold Ulmer, Hydrology.

b. Dam.

(1) Geology and Soils (Abutment and Embankment). Blackburn Pond Dam is located in the dissected till plains area within the Central Lowlands Physiographic Region. The dam is in a region where the stratigraphic sequence commonly consists of 10 to 20 feet of loess directly overlying bedrock of the Marmaton Group, Desmonsian Series, Pennsylvanian System. Strata of this group include shales, limestones, sandstones, and coal seams.

Geological reconnaissance of the area indicates 10 to 15 feet of loess mantling a gently rolling topography. Bedrock was not observed at this site.

The soil deposits in the dam area consist of upland soils of the Grundy-Pershing soil association. These soils are formed from loess overlying shales. The Grundy soils are positioned on broad, gently sloping interstream divides. The Pershing soils are positioned on the more gently sloping areas below the Grundy soils where the loess thins over underlying limestones and shales.

Materials in the embankment appear to be CL and CL-ML soils derived from loess.

(2) Upstream Slope. The upstream slope is quite steep (1.5 to 1 was the usual railroad grade slope) and partially covered with trees and brush. Portions of the slope are covered with concrete rubble and other rock riprap. No serious erosion was observed. Photos 2 and 3 show the upstream slope.

(3) Crest. The crest serves as the grade of the railroad. The profile of the crest shown in Plate C-1, Appendix C, slopes from the right to the left abutment with a maximum elevation difference of about 9 feet. The crest is covered with ballast. No cracks or deformations were noted. Photo No. 4 shows the crest.

(4) Downstream slope. The downstream slope is almost completely covered with small trees and brush. Some cleaning has been done on the left end to free utility lines as shown in Photo No. 5. No indications of seepage were noted on or along the slope. No abnormal deformation nor erosion was observed. However, conditions of the slope were difficult to observe. Photos 5, 6 and 7 show the downstream slope.

c. Appurtenant Structures.

(1) The spillway consists of a concrete box riser with weir crest connected to a concrete arch conduit. Concrete in the riser section is badly deteriorated, cracked, and spalled with some reinforcing steel exposed as shown in Photos 9, 10, 11 and 14. Considerable leakage occurs into the riser from an area about 6.5 feet down from the crest. Most of the leakage occurs in the left corner and side of the riser as shown in Photos 9, 10, 11, 12 and 13. Leakage into the riser was estimated to be 1-2 gpm. The concrete in the conduit is spalling and deteriorating, particularly about midway through the conduit. However, there was very little seepage into the roof or sides of the conduit. The conduit is shown in Photos 8, 15 and 16.

(2) Drawdown facility. There is no drawdown facility for this dam.

d. Reservoir Area. The reservoir area is well vegetated around the waterline. No slumps, slides, or severely eroded areas were observed around the shoreline. Photo No. 19 shows a portion of the reservoir with Highway 20 crossing the upper (south) end of the lake.

e. Downstream Channel. The channel downstream from the spillway is open, clean and stable. Photos 17 and 18 show the downstream channel.

3.2 EVALUATION

This dam appears to be in fair condition, except that the slopes are almost completely overgrown with trees and brush. The dam has been in place for 50 years or more, during which time it must have been subjected to near maximum stresses without any evidence of failure. The spillway riser is in poor condition due to concrete deterioration. This deterioration will undoubtedly accelerate as time goes on unless some remedial measures are undertaken. Uncontrolled tree growth on the slopes of the dam could ultimately impair the stability of the dam.

This dam does not appear to have a serious potential of failure.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam. The pool level is controlled by rainfall, infiltration, evaporation, and the capacity of the uncontrolled spillways.

4.2 MAINTENANCE OF DAM

The uncontrolled tree growth on the dam and the concrete deterioration in the spillway would indicate almost complete lack of maintenance on this structure (at least for the last several years).

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system in effect for this dam.

4.5 EVALUATION

No operational procedures exist for this dam. The lack of routine maintenance and repair is responsible for poor condition of the spillway. The deterioration of the spillway will undoubtedly accelerate as time goes on, unless some remedial measures are undertaken.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were found for this dam.

b. Experience Data. The drainage area, reservoir surface area, and elevation-storage data were developed from the USGS Blackburn, Missouri 7.5 minute topographic quadrangle map. The hydraulic computations for the spillway and dam overtopping discharge ratings were based on data collected in the field at the time of the field inspection.

c. Visual Observations.

(1) A highway embankment (Highway 20) with a 72-inch diameter CMP culvert is located upstream of the dam and would impound approximately 7 acre-feet of water before overtopping. (See Photos 1, 21 through 24).

(2) Both the spillway riser and outlet conduit were badly deteriorated and spalled. The reinforcing steel was exposed in the riser section. Clear seepage was coming out of the upstream and left wall of the riser approximately 6.5 feet down from the crest. There was a seepage discharge at the outlet of approximately one gallon per minute. (See Photos 8 through 16).

(3) There is neither an emergency spillway nor a drawdown facility for this structure.

d. Overtopping Potential. The spillways are too small to pass the probable maximum flood without overtopping. The spillways will pass the 1% probabilistic flood as well as 68% of the probable maximum flood without overtopping the dam. Since approximately 78% of the drainage area (0.21 square miles) is located upstream of the highway embankment, the storms were first routed through the U. S. Highway 20 embankment just upstream of the dam. The storms were then routed through the dam to accurately model the hydrologic system above the dam.

The results of the routings through the dam are tabulated in regards to the following conditions:

Frequency	Inflow Discharge c.f.s.	Outflow Discharge c.f.s.	Maximum Pool Elevation	* Maximum Depth Over Dam Feet	Duration Over Top Hr.
1/2 PMF	1440	930	783.6	0	0
PMF	2900	2150	786.6	1-	1.2
68% PMF	1980	900	785.6	0	0

* Minimum Top of Dam Elevation - 785.6

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a significant hazard rating and a small size. Therefore, the 1% probabilistic flood to the ½ PMF is the test for the adequacy of the dam and its spillway.

The estimated damage zone is described in Paragraph 1.2d in this report.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation. The dam appears to be structurally stable. It has been in place for 50 years or more and shows no evidence of distress. The structural stability of the spillway is not known. The riser is in poor condition but failure of the massive reinforced concrete structure does not appear to be likely for many years to come. Most of the trees on the embankment slopes are relatively small and should not impose any immediate danger to the stability of the structure.

b. Design and Construction Data. No design or construction data were available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. However, the dam has been in place for 50 years or more and does not show signs of distress from lack of shear strength or from excess seepage pressures.

c. Operating Records. There are no controlled operating facilities for this dam.

d. Post Construction Changes. There are no post construction changes other than those discussed in Section 1.2, paragraph g., that affect the stability of this structure.

e. Seismic Stability. This dam is located in Seismic Zone 1, an earthquake of the magnitude predicted in this area is not expected to cause structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. This dam does not appear to have a serious potential of failure. It is hydrologically adequate to pass the 50 percent of the probable maximum flood without overtopping. Repairing the concrete in the spillway and removing trees from the embankment slopes should prolong the life of this structure for many years to come.

b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report are based upon performance history and visual observations. Seepage and stability analyses comparable to the requirements of the guidelines were not available. However, the dam has been in place for 50 years or more, and does not show signs of distress from lack of shear strength or from excess seepage pressures.

c. Urgency. There does not appear to be an immediate urgency to accomplish the remedial measures recommended in paragraph 7.2.

d. Necessity for Further Investigations. Further investigations are not required.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to be hazardous to this dam.

7.2 REMEDIAL MEASURES

The following remedial measures and maintenance procedures are recommended:

a. Alternatives. Since the dam and spillway can accommodate at least 50 percent of the PMF, no alternative measures are required.

b. Operating and Maintenance Procedures.

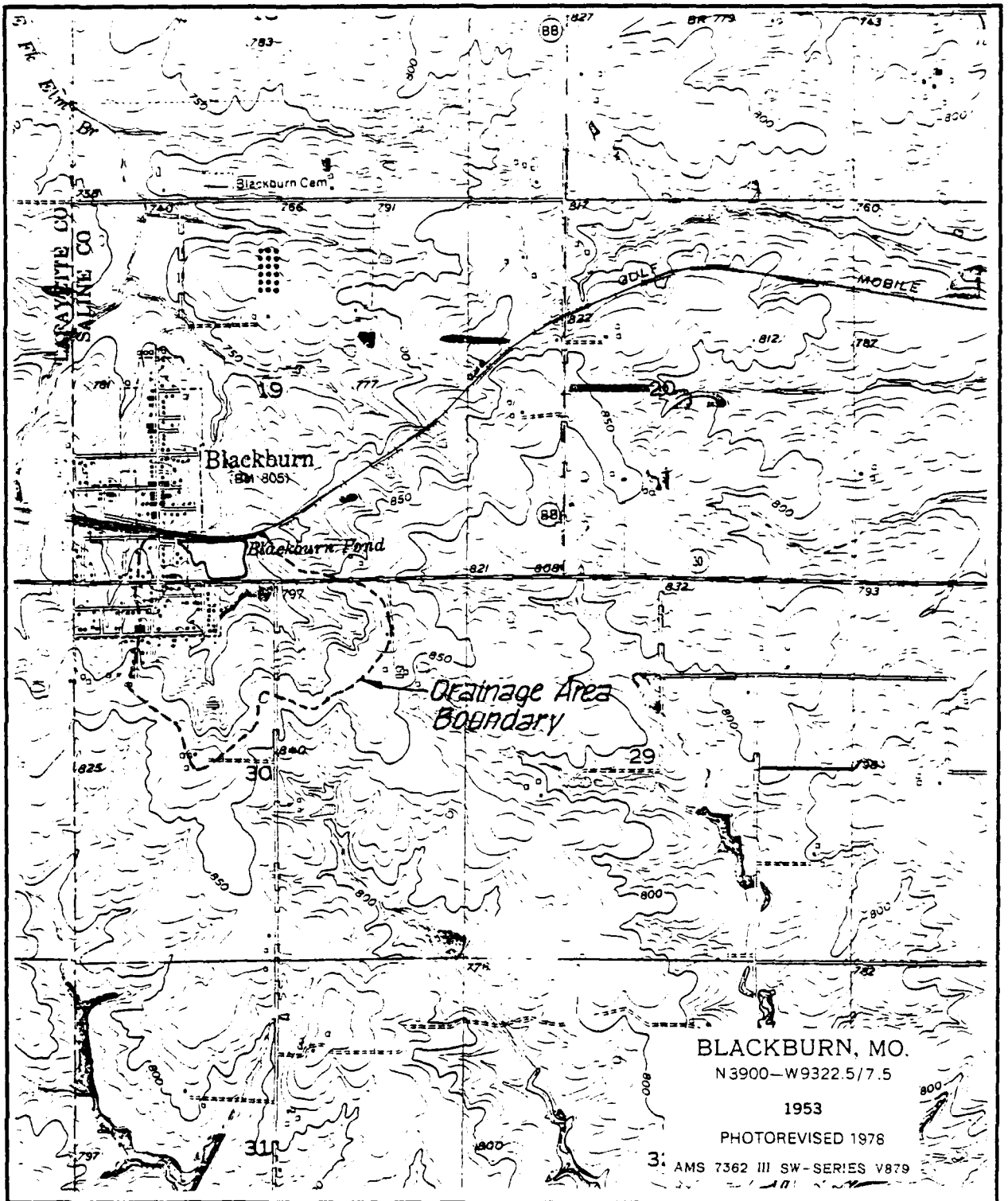
(1) Trees should be removed from the embankment and measures taken to prevent their recurrence.

Large trees or trees with an extensive system of roots should be removed under the guidance of an engineer experienced in the design and construction of dams.

(2) The concrete in the spillway should be repaired.

(3) A program of regular inspection and maintenance should be established.

APPENDIX A
MAPS



Scale in feet

2000 1000 0 2000 4000

Contour Interval – 10'

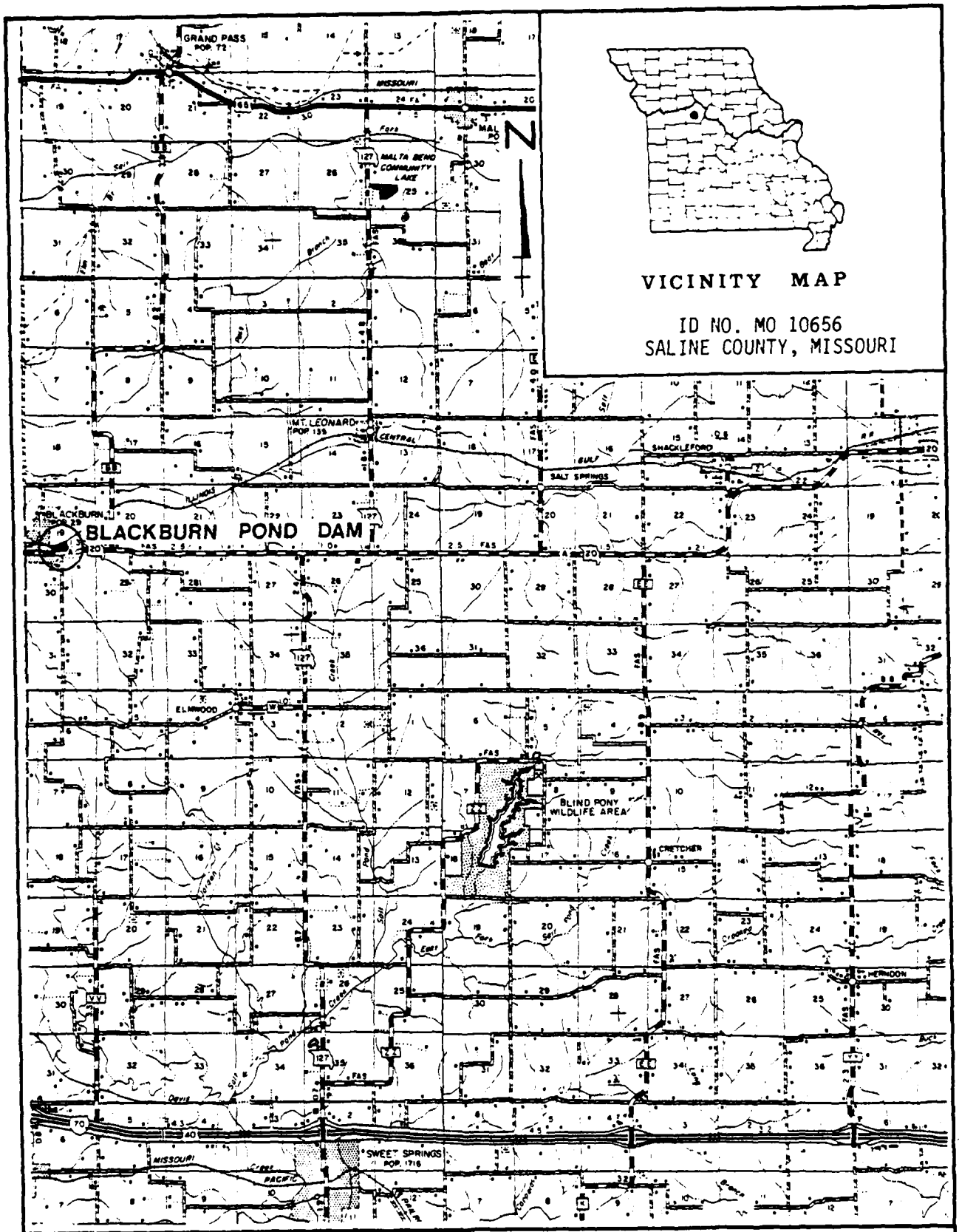
N

VICINITY TOPOGRAPHY

BLACKBURN POND DAM

SALINE COUNTY, MISSOURI

MO. 10656 PLATE A-1


GRAND PASS
POP. 72
MISSOURI
MALTA BEND
COMMUNITY
LAKE
MT. LEONARD
POP. 135
CENTRAL
GULF
SHACKLEFORD
SALT SPRINGS
BLACKBURN
POP. 29
BLACKBURN POND DAM 1
ELMWOOD
BLIND PONY
WILDLIFE AREA
CRETCHER
HERNDON
SWEET SPRINGS
POP. 1716
MISSOURI
PACIFIC
N
VICINITY MAP
ID NO. MO 10656
SALINE COUNTY, MISSOURI
Scale in miles
0 1 2 3 4 5
LOCATION MAP
PLATE A-2

APPENDIX B
PHOTOGRAPHS

BLACKBURN POND
SALINE COUNTY, MISSOURI
MO 10656

PHOTO INDEX

PLATE B-1

PHOTO NO. 2 - UPSTREAM SLOPE FROM LEFT END

PHOTO NO. 3 - UPSTREAM SLOPE FROM RIGHT END

FORM 2

PHOTO NO. 4 - CREST FROM LEFT END

PHOTO NO. 5 - DOWNSTREAM SLOPE FROM LEFT END

PHOTO NO. 6 - DOWNSTREAM SLOPE FROM RIGHT END

PHOTO NO. 7 - DOWNSTREAM SLOPE FROM STA. 4+00 LOOKING TO EAST (RIGHT)

PHOTO NO. 8 - VIEW OF CONDUIT FOR SPILLWAY OUTLET

PHOTO NO. 9 - EXPOSED STEEL IN RIGHT WALL OF SPILLWAY OUTLET STRUCTURE. SEEPAGE AT BOTTOM

PHOTO NO. 10 - DETERIORATED CONDITION OF SPILLWAY STRUCTURE SHOWING EXPOSED STEEL, WALLCRACKS, SPALLING CONCRETE AND SEEPAGE

PHOTO NO. 11 - CLOSE-UP VIEW OF EXPOSED STEEL SHOWN IN PHOTO NO. 10

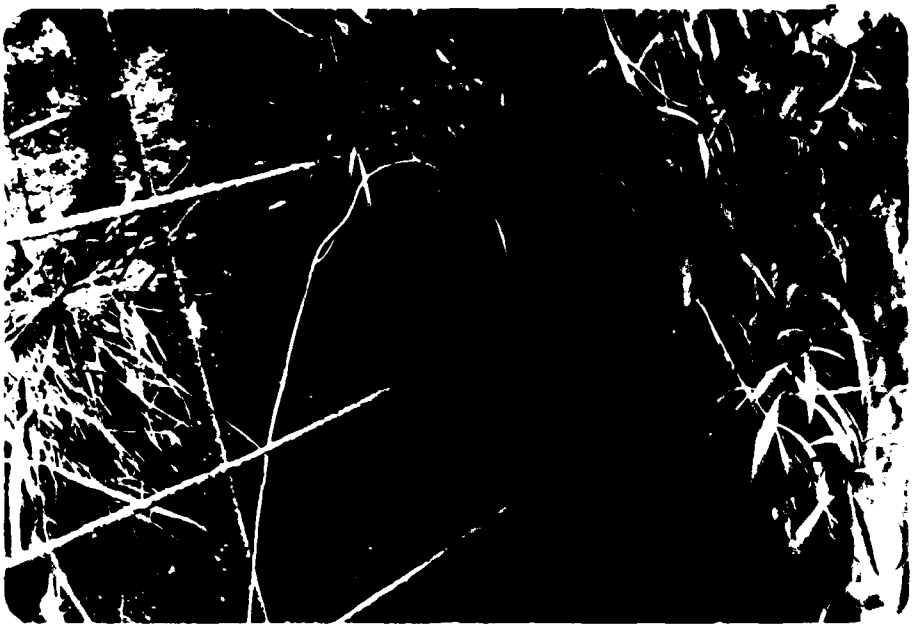


PHOTO NO. 12 - CLOSE-UP SHOWING SEEPAGE COMING OUT OF LEFT WALL OF SPILLWAY STRUCTURE

PHOTO NO. 13 - SEEPAGE FROM LEFT WALL OF SPILLWAY STRUCTURE. SEEPAGE EMERGES 6½ FEET DOWN FROM CREST OF SPILLWAY

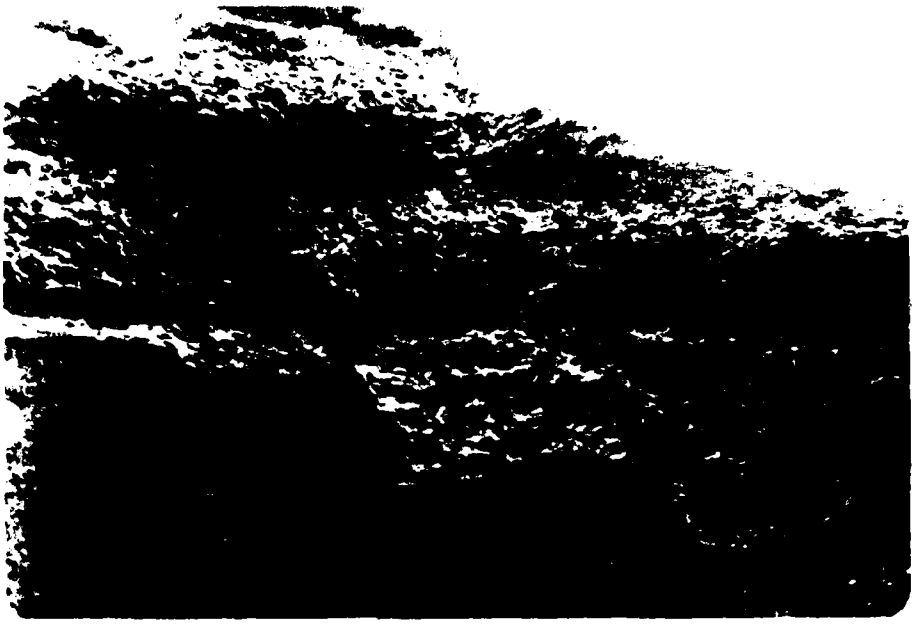


PHOTO NO. 14 - SPALLING OF UPSTREAM WALL OF SPILLWAY STRUCTURE

PHOTO NO. 15 - VIEW LOOKING DOWN THE OUTLET TUNNEL

PHOTO NO. 16 - OUTLET END OF SPILLWAY SHOWING DETERIORATION OF CONCRETE AND SEEPAGE WATER

PHOTO NO. 17 - VIEW DOWNSTREAM FROM END OF SPILLWAY TUNNEL

PHOTO NO. 18 - VIEW OF DOWNSTREAM CHANNEL FROM STA. 5+80

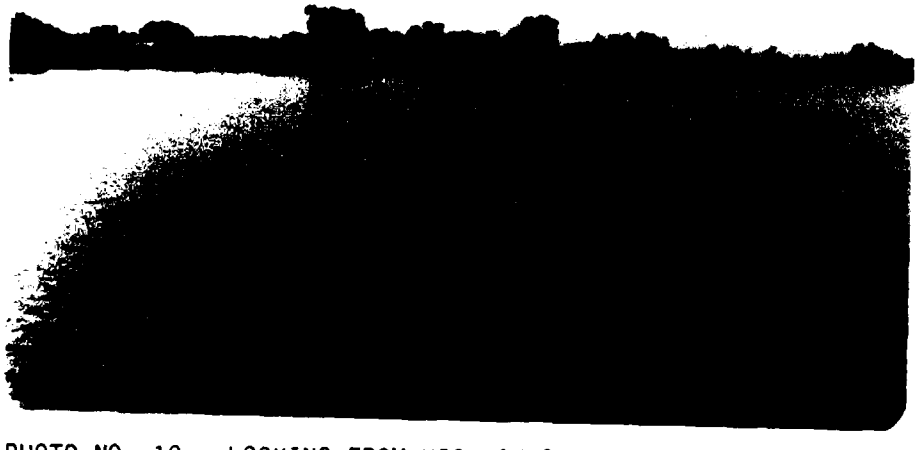


PHOTO NO. 19 - LOOKING FROM HIGHWAY 20 CULVERT NORTHWARD INTO DAM - SPILLWAY SHOWS IN CENTER OF PICTURE

FORM 2

PHOTO NO. 20 - UPSTREAM VIEW OF HIGHWAY 20 FILL ACROSS UPPER END OF LAKE

PHOTO NO. 21 - HIGHWAY 20 CROSSING UPPER PART OF LAKE

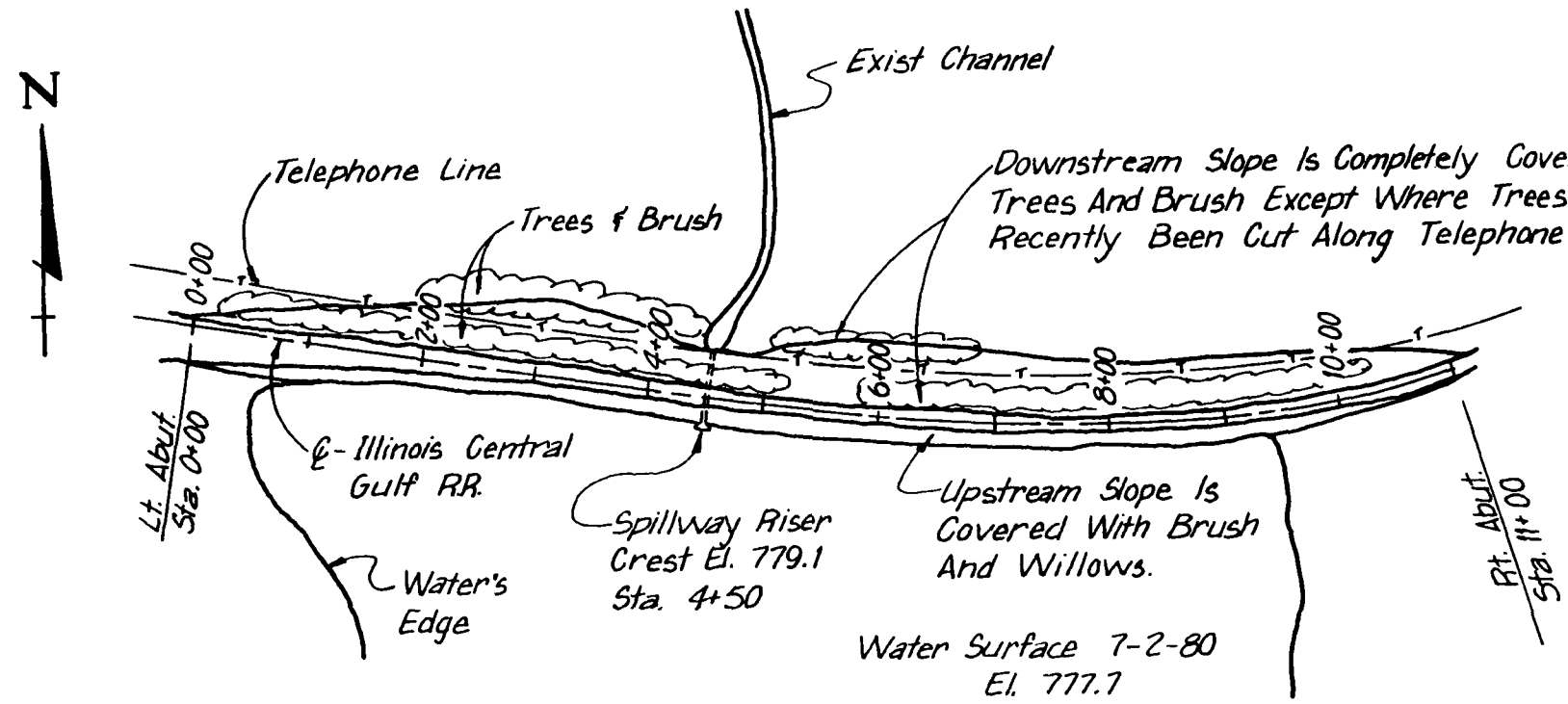
PHOTO NO. 22 - INLET END OF CULVERT UNDER HIGHWAY 20, CONNECTING UPPER AND LOWER LAKES

PHOTO NO. 23 - OUTLET END OF CULVERT UNDER HIGHWAY 20

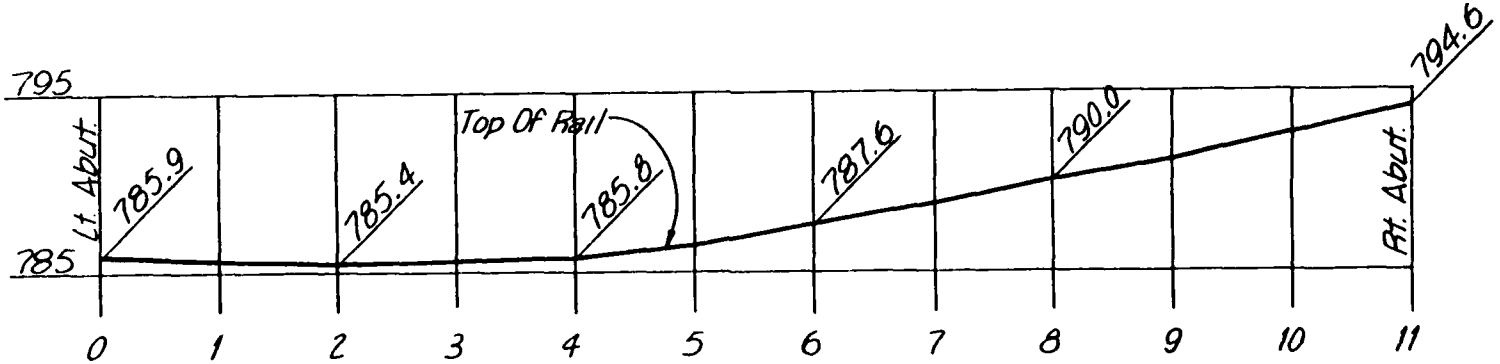
FORM 2

PHOTO NO. 24 - LOOKING SOUTH FROM THE DAM INTO THE HIGHWAY 20 CROSSING - ROAD CULVERT IS NEAR CENTER OF PICTURE.

APPENDIX C
PROJECT PLATES

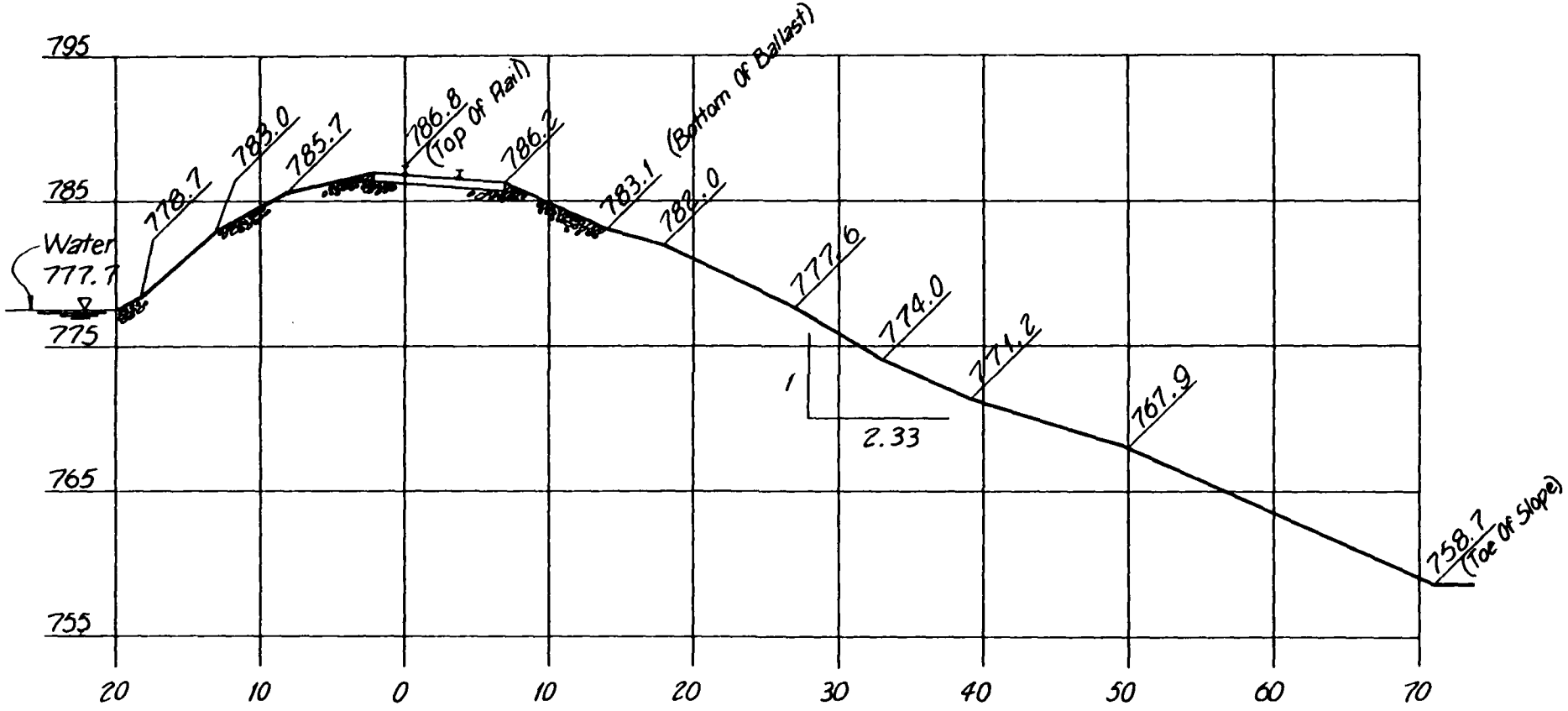


PLAN OF DAM
Scale: 1" = 150'



PROFILE ALONG CENTERLINE OF DAM
Scale: 1" = 150' H.; 1" = 10' V.

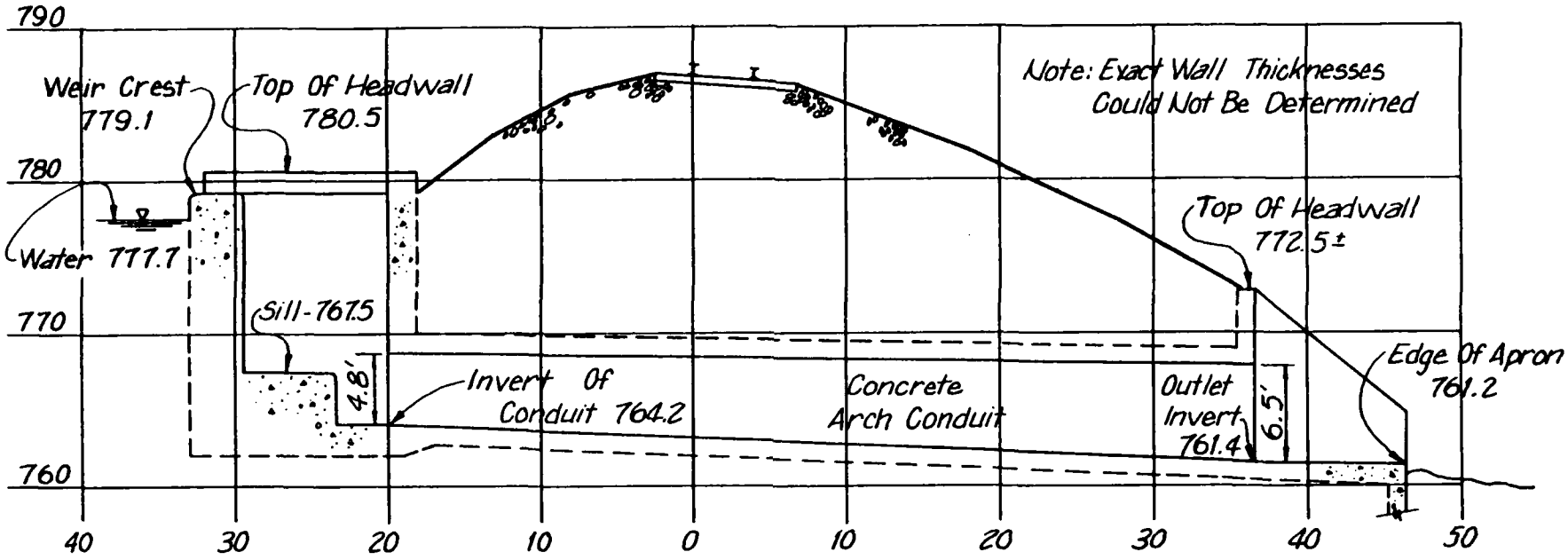
PLATE C-1



CROSS SECTION OF DAM AT STA. 5+80

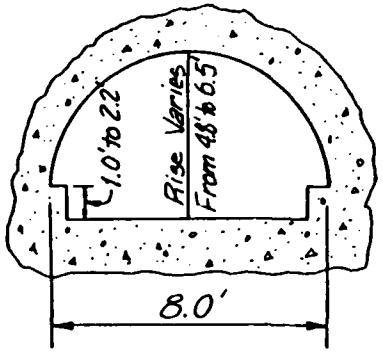
Scale: 1" = 10' H. & V.

PLATE C-2



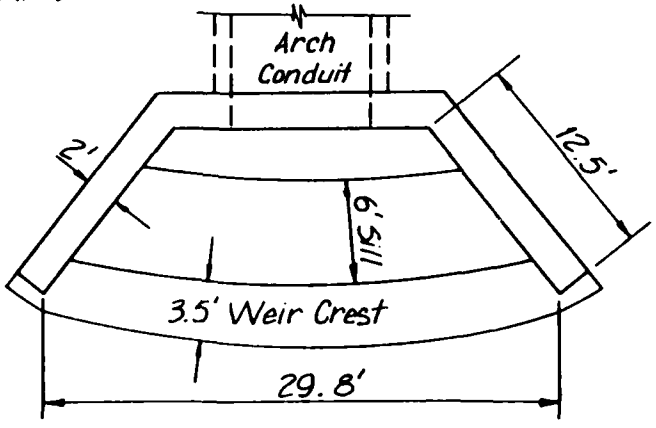
CROSS SECTION AT STA. 4+50 SHOWING SPILLWAY

Scale: 1" = 10' H. & V.



CROSS SECTION OF CONDUIT

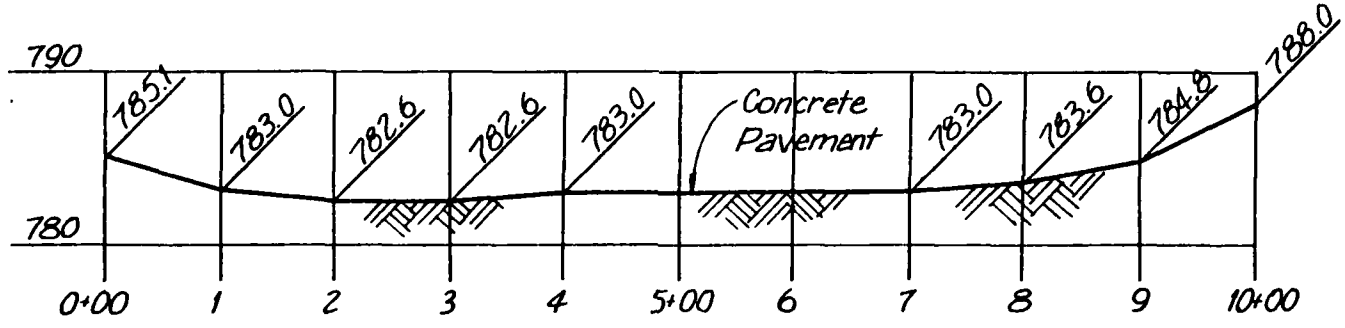
Scale: 1" = 5.0'



PLAN OF CONC. RISER & WEIR

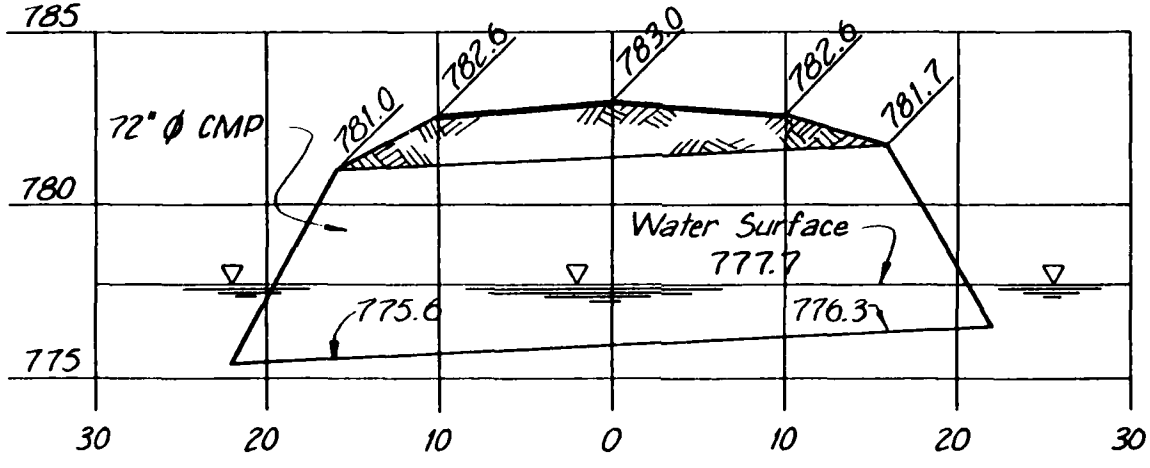
Scale: 1" = 1.0'

PLATE C-3



PROFILE ALONG CENTERLINE OF HIGHWAY 20 EMBANKMENT

Scale: 1"= 150'H.; 1"= 10'V.



SECTION OF HIGHWAY 20 EMBANKMENT AT STA. 4+60

Scale: 1"= 10'H.; 1"= 5'V.

PLATE C-4

APPENDIX D
HYDRAULIC AND HYDROLOGIC DATA

HYDROLOGIC COMPUTATIONS

1. The SCS dimensionless unit hydrograph and the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Corps of Engineers, Davis, California, were used to develop the inflow hydrographs (See this Appendix.)

   a. Twenty-four hour, one percent probabilistic rainfall for the dam location was taken from the data for the rainfall station at Sweet Springs, MO. as supplied by the St. Louis District, Corps of Engineers per their letter dated 4 March 1980. The twenty-four hour probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis policy and guidance for hydraulics and hydrology. The rainfall was distributed by using the distribution as described by EM 1110-2-1411 (Standard Project Storm).

   b. Drainage area = 0.27 square miles (171 acres); 0.21 square miles (134 acres) of the drainage area is above the U. S. Highway 20 embankment.

   c. Time of concentration of runoff was computed using the SCS "Upland" Method. The area south of Highway 20 has a time of concentration equal to 19 minutes. The remaining area which drains directly into Blackburn Pond has a time of concentration of 7 minutes. The time of concentration was verified by using the "Kirpich" Method.

   d. The antecedent storm conditions for the probable maximum precipitation were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMC III). The antecedent storm conditions for the one percent probabilistic precipitation were an average of the conditions which have preceded the occurrence of the maximum annual flood on numerous watersheds (SCS AMC II). The initial pool elevation was assumed at the crest of the spillway riser.

   e. The total twenty-four hour storm duration losses for the one percent probabilistic storm were 2.57 inches. The total losses for the PMF storm were 1.30 inches. These data are based on SCS runoff curve No. 90 and No. 78 for antecedent moisture conditions SCS AMC III and AMC II respectively. The watershed is composed of primarily SCS soil groups B and C (Marshall and Higginsville soil respectively). Approximately one-half of the watershed is in cropland with terraces and waterways. A quarter of the watershed is in pasture; while the other quarter consists of roads and housing.

f. Average soil loss rates = 0.05 inch per hour approximately.

2. The combined discharge rating for the dam consisted of two components: the flow through the spillway and the flow going over the top of the dam.

   a. The spillway rating was developed using both the weir flow and orifice equations. Full conduit flow never occurs as the small upstream end of conduit (entrance control/orifice flow) controls above equation 783.0+ feet. The equations used are as follows:

      (1) Weir flow equation: $Qw = CLH^{1.5}$
      where C = weir coefficient = varies from 2.44 to 3.32 (from Table 47, Handbook of Hydraulics, H.W. King, 4th Ed.)
      L = weir length, ft. = 30
      H = total head, ft. = Pool elevation - 779.1

      (2) Orifice flow equation: $Qo = CA\sqrt{2gH}$
      where C = weir coefficient = 0.6 (from SCS T.R. 29)
      A = cross-sectional area of conduit at upstream end, ft^2 = 43.2
      H = total head ft. = Pool elevation - 766.6

   b. The flows over the dam were developed using the dam overtopping analysis (flow over non-level dam crest) within the HEC-1 (Dam Safety Version) program.

3. Floods were routed through the reservoir using the HEC-1 (Dam Safety Version) program to determine the capabilities of the spillway and dam embankment crest. The storms were first routed through the U.S. Highway 20 embankment just upstream of the dam and the routed through the dam to accurately model the hydrologic system above the dam. The input, output, and plotted hydrographs are exhibited in this Appendix.

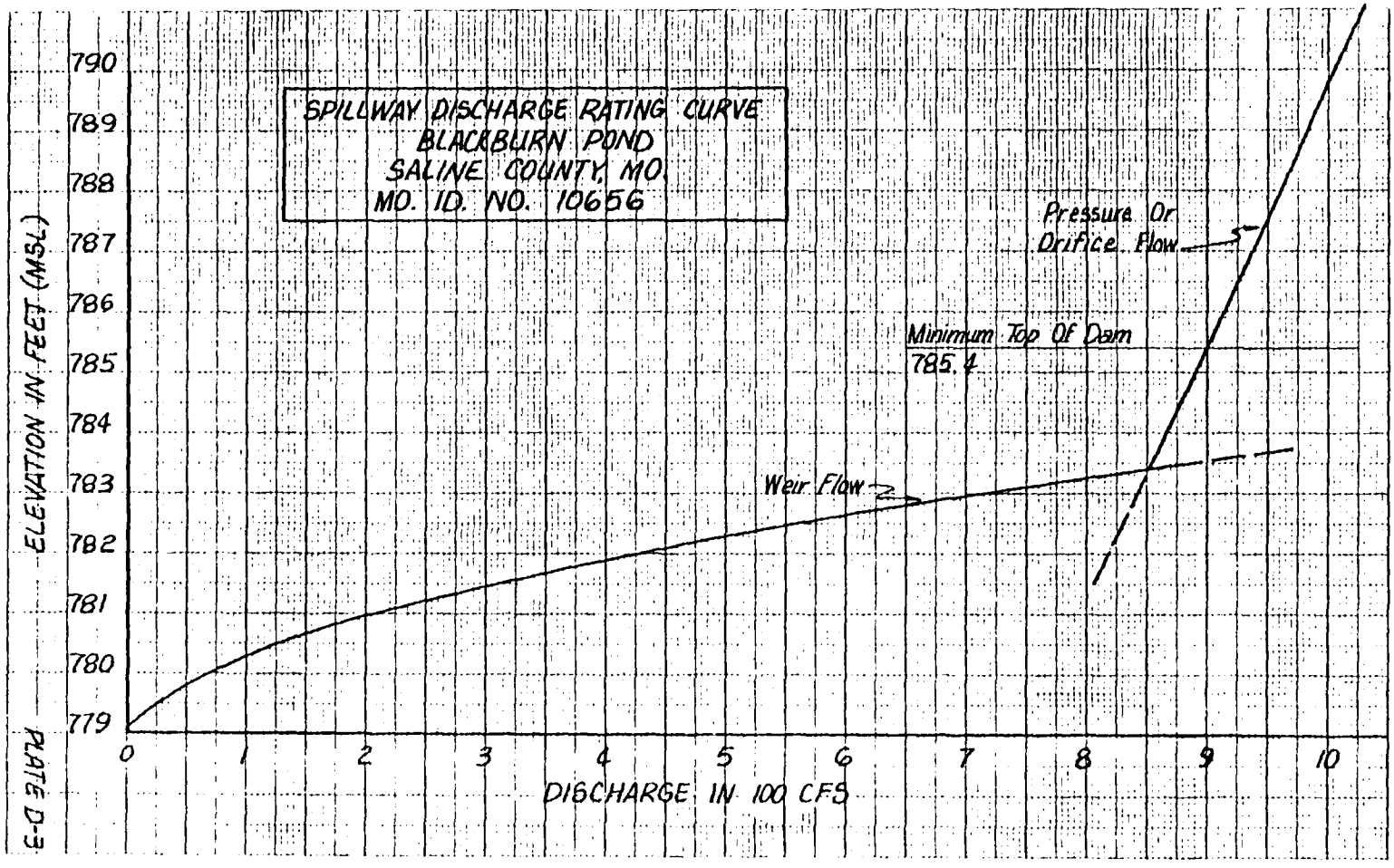

SPILLWAY DISCHARGE RATING CURVE
BLACKBURN POND
SALINE COUNTY, MO.
MO. ID. NO. 10656
ELEVATION IN FEET (MSL.)
790
789
788
787
786
785
784
783
782
781
780
779
0
1
2
3
4
5
6
7
8
9
10
DISCHARGE IN 100 CFS
Pressure Or Orifice Flow
Minimum Top Of Dam 785.4
Weir Flow

PLATE D-3

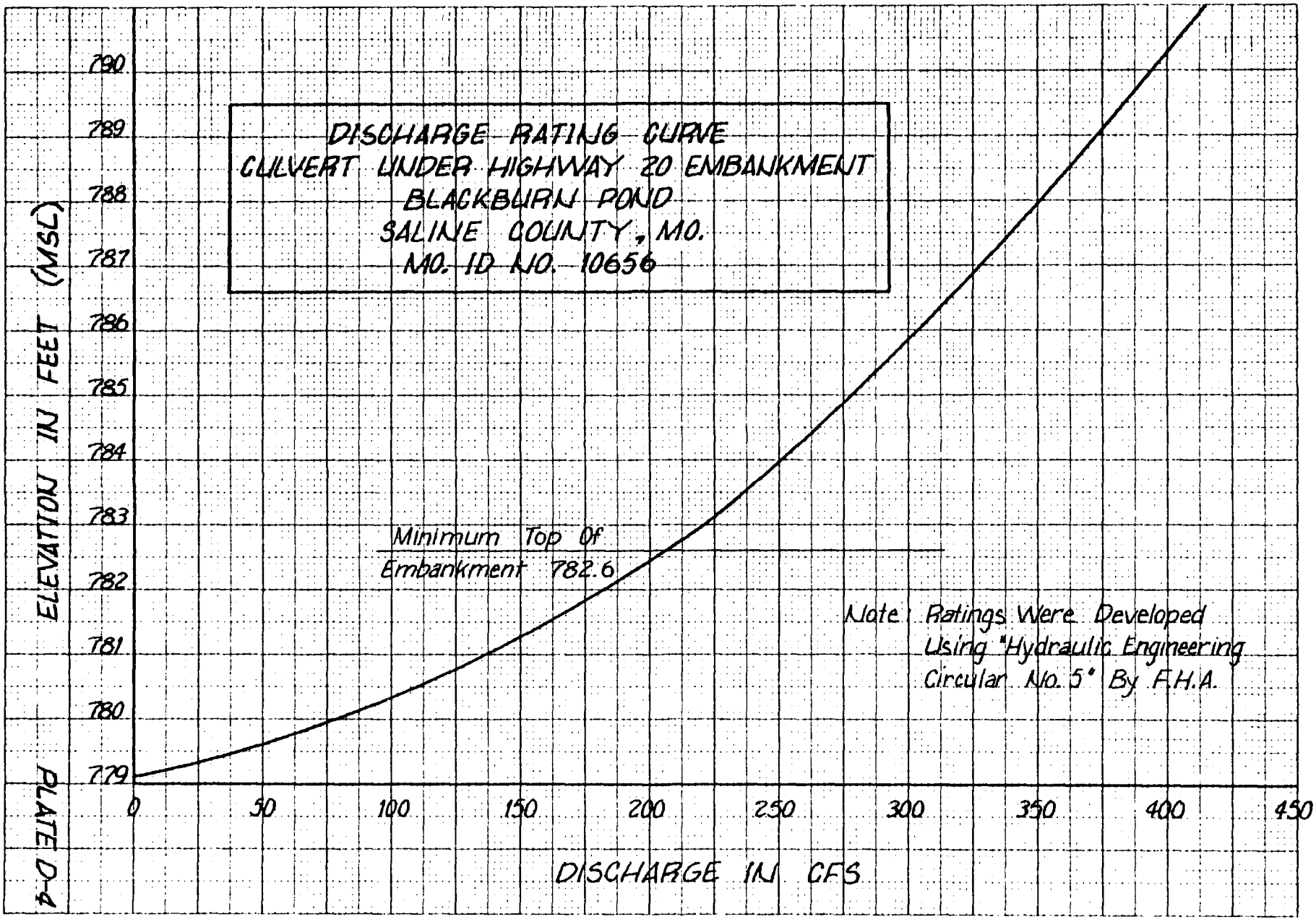


PLATE D-4

LISTING OF CARD INPUT DATA

```
A1      ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
A2      H & H ANALYSIS OF SAFETY OF BLACKBURN POND-MO 10656
A3      RATIOS OF PMF ROUTED THROUGH THE RESERVOIR
B 0002880000000000000005                        0000000000000000000000003
B1000005
J 000001000000600000001
J1000.5000000.6000000.7000000.8000000.9000001.0
K 00000000000001                000000000000000000000001
K1      CALCULATION OF INFLOW HYDROGRAPH TO HWY 20 EMBANKMENT
0000000100000200000.21        00000.21  000001.0                 00000001
P 000000000024.70000010200000012100000130
T                                                   -1.0   -90.0
W2      00000.19
X 000000    -.0100000001
K 0000100000002                 000000020000000000000001
K1      ROUTED FLOWS THRU HWY 20 EMBANKMENT
Y                       0000000100000001
Y1000001                                          -779.0      -1
Y40779.1000780.8000781.3000782.4000785.9000790.3000795.2
Y500000000000125000001500000020000000300000004000000500
$A00000000001.1400000006
$E000776000007790000790
$$0776.3
$D0782.6000002.9000001.500001000
$L000100000005950000077000000900000009800000106000001140
$V0782.6000783.0000784.0000785.0000786.0000787.0000788.0
K 00000000000003                000000020000000000000001
K1      CALCULATION OF INFLOW HYDROGRAPH TO DAM EMBANKMENT
M 0000010000000200000.06        00000.06000001.0                 00000001
P 000000000024.70000010200000012100000130
T                                                   -1.0   -90.0
W2      00000.07
X 000000    -.0100000001
K      2SUM 2+3                         2       0       1
K1      INFLOW HYDROGRAPH TO RESERVOIR 10656
K 0000100000004                 000000020000000000000001
K1      ROUTED FLOWS THRU RESERVOIR 10656
Y                       0000000100000001
Y1000001                                          -779.0      -1
Y40779.1000779.5000780.0000780.5000781.0000781.5000782.0000782.5000783.0000783.5
Y40784.0000785.0000786.0000787.0000788.0000789.0000790.0
Y500000000019.6000067.9000133.2000213.7000320.1000432.6000556.7000709.3000855.1
Y50867.6000892.2000916.1000939.5000962.2000984.4001006.2
$A000000000008.3000013.1
$E000764000007790000790
$$0779.1
$D0785.4000002.9000001.500001100
$L000000000002000000041000000530000007300000086000001000
$V0785.4000785.6000786.0000787.0000788.0000789.0000790.0
K 000099
A
A
A
A
A
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT        000001
ROUTE HYDROGRAPH TO         000002
RUNOFF HYDROGRAPH AT        000003
COMBINE  2 HYDROGRAPHS AT M 2+3
ROUTE HYDROGRAPH TO         000004
END OF NETWORK
```

PLATE D-6

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************

RUN  DATE# 80/09/17.
     TIME# 17.03.03.
```

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
H & H ANALYSIS OF SAFETY OF BLACKBURN POND-MO 10656
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	5	0	0	0	0	0	3	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1

RTIOS= .50 .60 .70 .80 .90 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH TO HWY 20 EMBANKMENT

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000001	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	200	.21	0.00	.21	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.70	102.00	121.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-90.00	0.00	0.00

CURVE NO = -90.00 WETNESS = -1.00 EFFECT CN = 90.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .19

RECESSION DATA
STRTQ= 0.00 QRCSN= -.01 RTIOR= 1.00

UNIT HYDROGRAPH 13 END-OF-PERIOD ORDINATES, LAG= 0.00 HOURS, CP= 0.00 VOL= 1.00

114.	367.	433.	324.	171.	97.	54.	30.	17.	9.
5.	3.	1.							

0 END-OF-PERIOD FLOW

PLATE D-7

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.
1.01	.10	2	.01	0.00	.01	0.
1.01	.15	3	.01	0.00	.01	0.
1.01	.20	4	.01	0.00	.01	0.
1.01	.25	5	.01	0.00	.01	0.
1.01	.30	6	.01	0.00	.01	0.
1.01	.35	7	.01	0.00	.01	0.
1.01	.40	8	.01	0.00	.01	0.
1.01	.45	9	.01	0.00	.01	0.
1.01	.50	10	.01	0.00	.01	0.
1.01	.55	11	.01	0.00	.01	0.
1.01	1.00	12	.01	0.00	.01	0.
1.01	1.05	13	.01	0.00	.01	0.
1.01	1.10	14	.01	0.00	.01	0.
1.01	1.15	15	.01	0.00	.01	0.
1.01	1.20	16	.01	0.00	.01	0.
1.01	1.25	17	.01	0.00	.01	0.
1.01	1.30	18	.01	.00	.01	0.
1.01	1.35	19	.01	.00	.01	0.
1.01	1.40	20	.01	.00	.01	0.
1.01	1.45	21	.01	.00	.01	0.
1.01	1.50	22	.01	.00	.01	1.
1.01	1.55	23	.01	.00	.01	1.
1.01	2.00	24	.01	.00	.01	1.
1.01	2.05	25	.01	.00	.01	2.
1.01	2.10	26	.01	.00	.01	2.
1.01	2.15	27	.01	.00	.01	2.
1.01	2.20	28	.01	.00	.01	3.
1.01	2.25	29	.01	.00	.01	3.
1.01	2.30	30	.01	.00	.01	3.
1.01	2.35	31	.01	.00	.01	4.
1.01	2.40	32	.01	.00	.01	4.
1.01	2.45	33	.01	.00	.01	4.
1.01	2.50	34	.01	.00	.01	5.
1.01	2.55	35	.01	.00	.01	5.
1.01	3.00	36	.01	.00	.01	5.
1.01	3.05	37	.01	.00	.01	6.
1.01	3.10	38	.01	.00	.01	6.
1.01	3.15	39	.01	.00	.01	6.
1.01	3.20	40	.01	.00	.01	6.
1.01	3.25	41	.01	.00	.01	7.
1.01	3.30	42	.01	.00	.01	7.
1.01	3.35	43	.01	.00	.01	7.
1.01	3.40	44	.01	.00	.01	7.
1.01	3.45	45	.01	.00	.01	8.
1.01	3.50	46	.01	.01	.01	8.
1.01	3.55	47	.01	.01	.01	8.
1.01	4.00	48	.01	.01	.01	8.
1.01	4.05	49	.01	.01	.01	8.
1.01	4.10	50	.01	.01	.01	9.
1.01	4.15	51	.01	.01	.01	9.
1.01	4.20	52	.01	.01	.01	9.
1.01	4.25	53	.01	.01	.01	9.
1.01	4.30	54	.01	.01	.01	9.
1.01	4.35	55	.01	.01	.01	9.
1.01	4.40	56	.01	.01	.01	10.
1.01	4.45	57	.01	.01	.01	10.
1.01	4.50	58	.01	.01	.01	10.
1.01	4.55	59	.01	.01	.01	10.
1.01	5.00	60	.01	.01	.01	10.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	12.05	145	.21	.20	.01	119.
1.01	12.10	146	.21	.20	.01	171.
1.01	12.15	147	.21	.20	.01	232.
1.01	12.20	148	.21	.20	.00	278.
1.01	12.25	149	.21	.21	.00	302.
1.01	12.30	150	.21	.21	.00	316.
1.01	12.35	151	.21	.21	.00	324.
1.01	12.40	152	.21	.21	.00	329.
1.01	12.45	153	.21	.21	.00	331.
1.01	12.50	154	.21	.21	.00	333.
1.01	12.55	155	.21	.21	.00	334.
1.01	13.00	156	.21	.21	.00	335.
1.01	13.05	157	.25	.25	.00	340.
1.01	13.10	158	.25	.25	.00	356.
1.01	13.15	159	.25	.25	.00	374.
1.01	13.20	160	.25	.25	.00	388.
1.01	13.25	161	.25	.25	.00	395.
1.01	13.30	162	.25	.25	.00	399.
1.01	13.35	163	.25	.25	.00	402.
1.01	13.40	164	.25	.25	.00	403.
1.01	13.45	165	.25	.25	.00	404.
1.01	13.50	166	.25	.25	.00	405.
1.01	13.55	167	.25	.25	.00	405.
1.01	14.00	168	.25	.25	.00	405.
1.01	14.05	169	.31	.31	.00	413.
1.01	14.10	170	.31	.31	.00	436.
1.01	14.15	171	.31	.31	.00	463.
1.01	14.20	172	.31	.31	.00	484.
1.01	14.25	173	.31	.31	.00	494.
1.01	14.30	174	.31	.31	.00	501.
1.01	14.35	175	.31	.31	.00	504.
1.01	14.40	176	.31	.31	.00	506.
1.01	14.45	177	.31	.31	.00	507.
1.01	14.50	178	.31	.31	.00	508.
1.01	14.55	179	.31	.31	.00	509.
1.01	15.00	180	.31	.31	.00	509.
1.01	15.05	181	.19	.19	.00	495.
1.01	15.10	182	.38	.38	.00	472.
1.01	15.15	183	.38	.38	.00	489.
1.01	15.20	184	.57	.57	.00	593.
1.01	15.25	185	.67	.67	.00	679.
1.01	15.30	186	1.63	1.62	.01	923.
1.01	15.35	187	2.68	2.67	.01	1508.
1.01	15.40	188	1.05	1.05	.00	2193.
1.01	15.45	189	.67	.67	.00	2356.
1.01	15.50	190	.57	.57	.00	2026.
1.01	15.55	191	.38	.38	.00	1563.
1.01	16.00	192	.38	.38	.00	1211.
1.01	16.05	193	.29	.29	.00	953.
1.01	16.10	194	.29	.29	.00	767.
1.01	16.15	195	.29	.29	.00	645.
1.01	16.20	196	.29	.29	.00	570.
1.01	16.25	197	.29	.29	.00	529.
1.01	16.30	198	.29	.29	.00	506.
1.01	16.35	199	.29	.29	.00	491.
1.01	16.40	200	.29	.29	.00	483.
1.01	16.45	201	.29	.29	.00	480.
1.01	16.50	202	.29	.29	.00	478.
1.01	16.55	203	.29	.29	.00	477.
1.01	17.00	204	.29	.29	.00	477.

PLATE D-8

PLATE D-9

1.01	10.15	123	.07	.06	.00	100.	1.01	22.15	267	.02	.02	.00	30.
1.01	10.20	124	.07	.06	.00	101.	1.01	22.20	268	.02	.02	.00	30.
1.01	10.25	125	.07	.06	.00	101.	1.01	22.25	269	.02	.02	.00	30.
1.01	10.30	126	.07	.06	.00	101.	1.01	22.30	270	.02	.02	.00	30.
1.01	10.35	127	.07	.06	.00	101.	1.01	22.35	271	.02	.02	.00	30.
1.01	10.40	128	.07	.06	.00	101.	1.01	22.40	272	.02	.02	.00	30.
1.01	10.45	129	.07	.06	.00	101.	1.01	22.45	273	.02	.02	.00	30.
1.01	10.50	130	.07	.06	.00	101.	1.01	22.50	274	.02	.02	.00	30.
1.01	10.55	131	.07	.06	.00	101.	1.01	22.55	275	.02	.02	.00	30.
1.01	11.00	132	.07	.06	.00	102.	1.01	23.00	276	.02	.02	.00	30.
1.01	11.05	133	.07	.06	.00	102.	1.01	23.05	277	.02	.02	.00	30.
1.01	11.10	134	.07	.06	.00	102.	1.01	23.10	278	.02	.02	.00	30.
1.01	11.15	135	.07	.06	.00	102.	1.01	23.15	279	.02	.02	.00	30.
1.01	11.20	136	.07	.06	.00	102.	1.01	23.20	280	.02	.02	.00	30.
1.01	11.25	137	.07	.06	.00	102.	1.01	23.25	281	.02	.02	.00	30.
1.01	11.30	138	.07	.06	.00	102.	1.01	23.30	282	.02	.02	.00	30.
1.01	11.35	139	.07	.06	.00	102.	1.01	23.35	283	.02	.02	.00	30.
1.01	11.40	140	.07	.06	.00	102.	1.01	23.40	284	.02	.02	.00	30.
1.01	11.45	141	.07	.06	.00	102.	1.01	23.45	285	.02	.02	.00	30.
1.01	11.50	142	.07	.06	.00	102.	1.01	23.50	286	.02	.02	.00	30.
1.01	11.55	143	.07	.06	.00	103.	1.01	23.55	287	.02	.02	.00	30.
1.01	12.00	144	.07	.06	.00	103.	1.02	0.00	288	.02	.02	.00	30.
									SUM	32.11	30.81	1.30	50002.
										(816.)	(783.)	(33.)	(1415.90)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2356.	560.	174.	174.	49992.
CMS	67.	16.	5.	5.	1416.
INCHES		24.80	30.76	30.76	30.76
MM		629.84	781.22	781.22	781.22
AC-FT		278.	344.	344.	344.
THOUS CU M		342.	425.	425.	425.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1178.	280.	87.	87.	24996.
CMS	33.	8.	2.	2.	708.
INCHES		12.40	15.38	15.38	15.38
MM		314.92	390.61	390.61	390.61
AC-FT		139.	172.	172.	172.
THOUS CU M		171.	212.	212.	212.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1413.	336.	104.	104.	29995.
CMS	40.	10.	3.	3.	849.
INCHES		14.88	18.45	18.45	18.45
MM		377.90	468.73	468.73	468.73
AC-FT		167.	207.	207.	207.
THOUS CU M		205.	255.	255.	255.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1649.	392.	122.	122.	34994.
CMS	47.	11.	3.	3.	991.
INCHES		17.36	21.53	21.53	21.53
MM		440.89	546.85	546.85	546.85
AC-FT		194.	241.	241.	241.
THOUS CU M		240.	297.	297.	297.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1884.	448.	139.	139.	39994.
CMS	53.	13.	4.	4.	1132.
INCHES		19.84	24.61	24.61	24.61
MM		503.87	624.98	624.98	624.98
AC-FT		222.	275.	275.	275.
THOUS CU M		274.	340.	340.	340.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2120.	504.	156.	156.	44993.
CMS	60.	14.	4.	4.	1274.
INCHES		22.32	27.68	27.68	27.68
MM		566.86	703.10	703.10	703.10
AC-FT		250.	310.	310.	310.
THOUS CU M		308.	382.	382.	382.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2356.	560.	174.	174.	49992.
CMS	67.	16.	5.	5.	1416.
INCHES		24.80	30.76	30.76	30.76
MM		629.84	781.22	781.22	781.22
AC-FT		278.	344.	344.	344.
THOUS CU M		342.	425.	425.	425.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTED FLOWS THRU HWY 20 EMBANKMENT

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000002	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-779.	-1

PLATE D-11

STAGE	779.10	780.80	781.30	782.40	785.90	790.30	795.20
FLOW	0.00	125.00	150.00	200.00	300.00	400.00	500.00
SURFACE AREA=	0.	1.	6.				
CAPACITY=	0.	1.	37.				
ELEVATION=	776.	779.	790.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
776.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
782.6	2.9	1.5	1000.

CREST LENGTH AT OR BELOW ELEVATION	100.	595.	770.	900.	980.	1060.	1140.
	782.6	783.0	784.0	785.0	786.0	787.0	788.0

STATION 000002, PLAN 1, RATIO 1 **0.5 PMF**

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	2.	2.	2.	3.
3.	3.	3.	3.	3.	4.	4.	4.	4.	4.
4.	4.	4.	4.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	6.	6.	6.
6.	6.	6.	8.	11.	16.	21.	25.	28.	31.
33.	35.	37.	38.	39.	40.	41.	42.	42.	43.
43.	44.	44.	45.	45.	45.	46.	46.	46.	47.
47.	47.	47.	48.	48.	48.	48.	48.	48.	49.
49.	49.	49.	49.	49.	49.	49.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.	50.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	52.	59.	71.	88.	104.	118.
128.	134.	140.	144.	148.	151.	154.	157.	161.	165.
170.	174.	178.	181.	184.	186.	189.	191.	192.	195.
199.	203.	206.	225.	243.	248.	251.	253.	254.	254.
252.	247.	243.	257.	304.	413.	674.	1040.	1186.	1050.
825.	637.	505.	409.	343.	301.	275.	260.	254.	248.
244.	242.	240.	239.	238.	234.	223.	213.	207.	205.
204.	203.	201.	200.	199.	197.	195.	190.	179.	164.
146.	125.	98.	76.	58.	45.	36.	29.	24.	21.
19.	18.	17.	16.	16.	16.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.		

STORAGE

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	3.	3.	3.	3.
4.	4.	4.	4.	4.	5.	5.	5.	5.	5.
5.	6.	6.	6.	6.	6.	6.	6.	6.	7.
7.	7.	7.	7.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	9.	9.	9.	9.
9.	9.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	6.	6.	5.
4.	4.	3.	3.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.		

STAGE

779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1
779.1	779.1	779.1	779.1	779.1	779.1	779.2	779.2	779.2	779.2
779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2
779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2
779.2	779.2	779.2	779.2	779.3	779.3	779.4	779.4	779.5	779.5
779.6	779.6	779.6	779.6	779.6	779.6	779.7	779.7	779.7	779.7
779.7	779.7	779.7	779.7	779.7	779.7	779.7	779.7	779.7	779.7
779.7	779.7	779.7	779.7	779.7	779.8	779.8	779.8	779.8	779.8
779.8	779.8	779.8	779.6	779.8	779.8	779.8	779.8	779.8	779.8
779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8
779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8
779.8	779.8	779.8	779.8	779.8	779.9	780.1	780.3	780.5	780.7
780.9	781.0	781.1	781.2	781.3	781.3	781.4	781.5	781.5	781.6
781.7	781.8	781.9	782.0	782.0	782.1	782.1	782.2	782.2	782.3
782.4	782.5	782.6	782.7	782.8	782.8	782.8	782.8	782.8	782.8
782.8	782.8	782.8	782.8	782.9	783.0	783.2	783.3	783.4	783.3
783.2	783.1	783.1	783.0	782.9	782.9	782.8	782.8	782.8	782.8
782.8	782.8	782.7	782.7	782.7	782.7	782.7	782.7	782.6	782.6
782.5	782.5	782.5	782.4	782.4	782.3	782.3	782.2	781.9	781.6
781.2	780.8	780.4	780.1	779.9	779.7	779.6	779.5	779.4	779.4
779.4	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3
779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3
779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3
779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3
779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3
779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3		

PEAK OUTFLOW IS 1186. AT TIME 15.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1186.	276.	87.	87.	24958.

CMS	34.	0.	2.	2.	707.
INCHES		12.22	15.36	15.36	15.36
MM		310.49	390.02	390.02	390.02
AC-FT		137.	172.	172.	172.
THOUS CU M		169.	212.	212.	212.

PLATE D-14

OVF

STATION000002 **0.5 PMF**

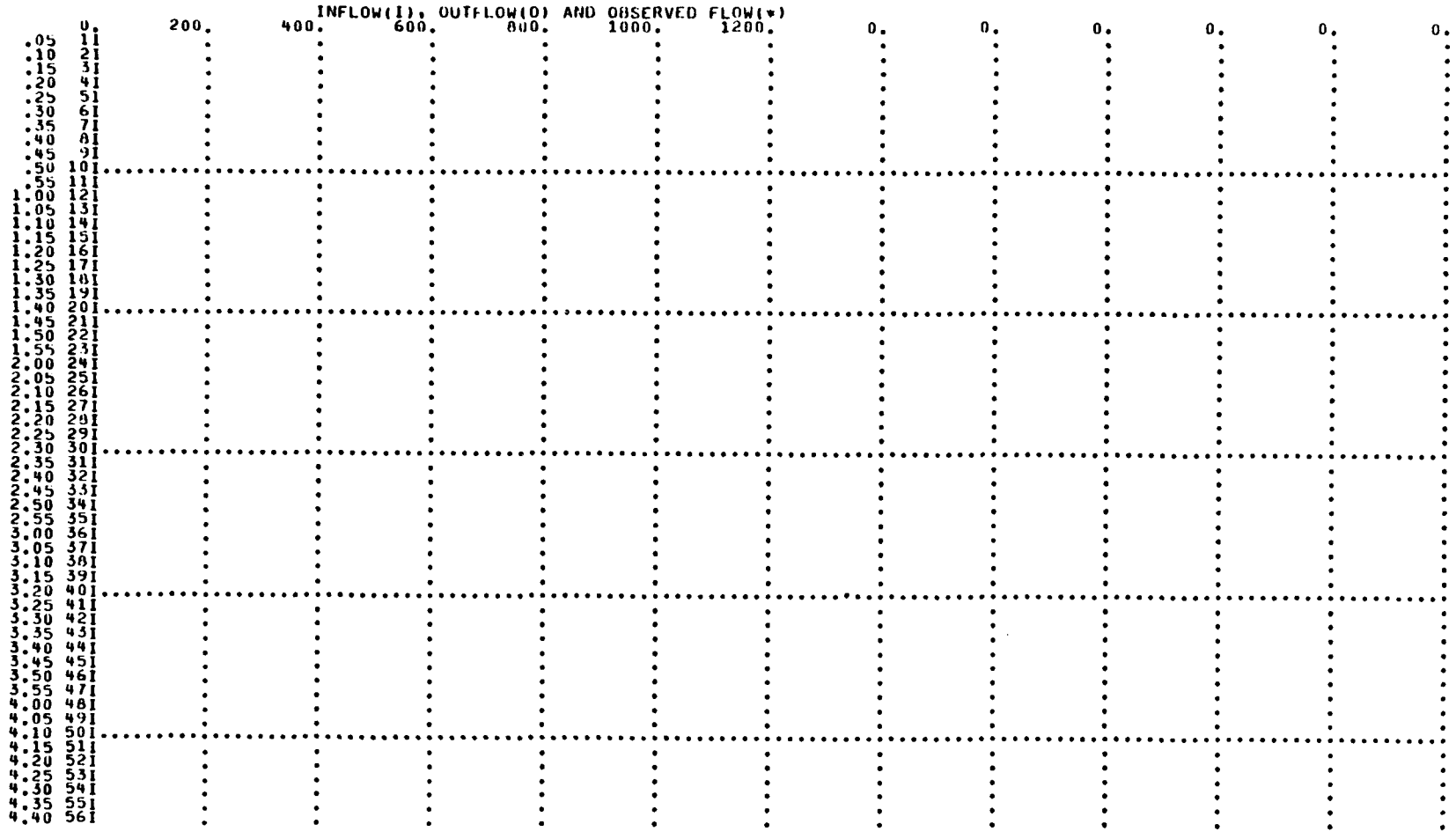


PLATE D-15

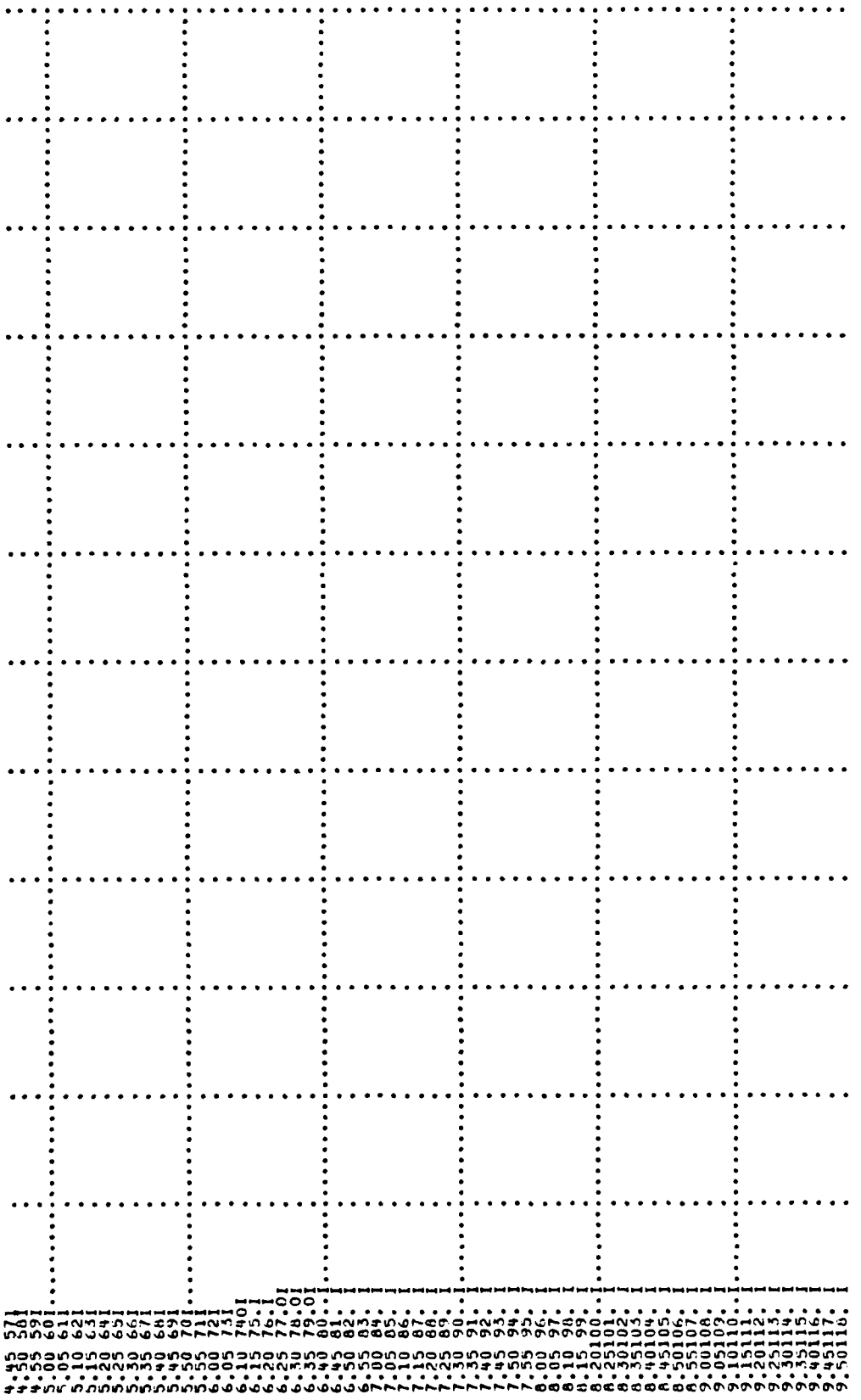


PLATE D-16

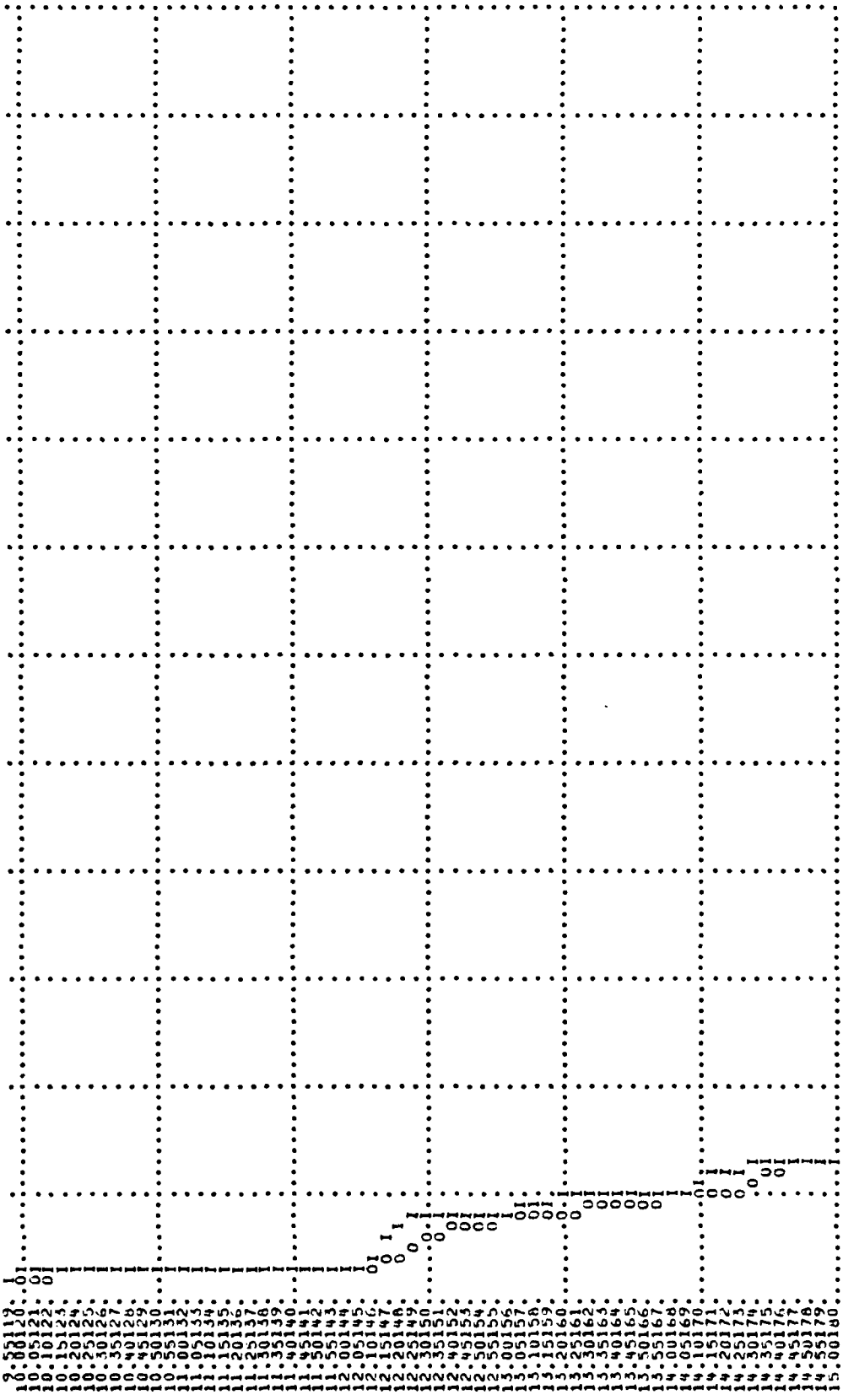


PLATE D-17

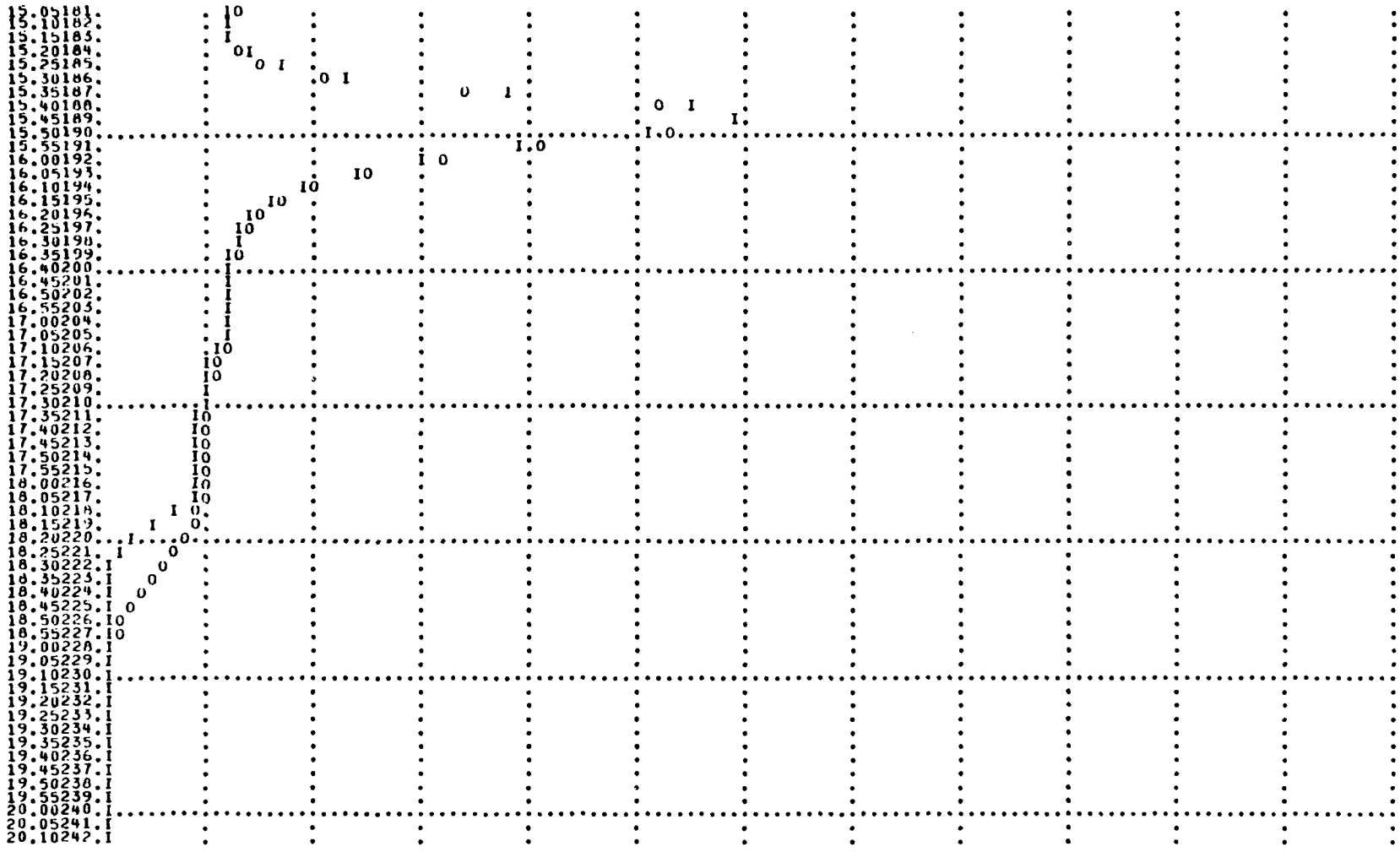


PLATE D-18

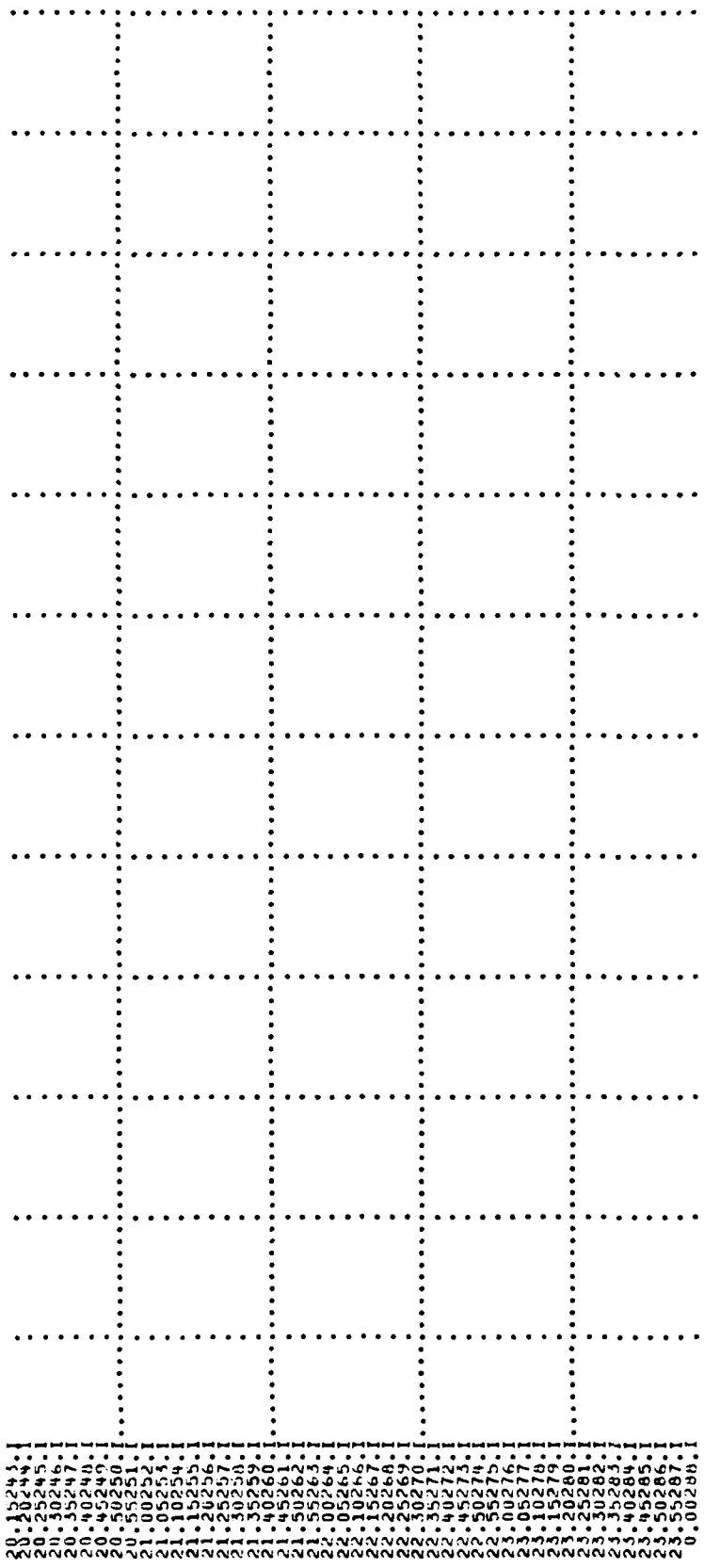


PLATE D-19

OVN

STATION 000002, PLAN 1, RATIO 6 PMF

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	2.	3.	3.	4.	4.	5.	5.	5.	6.
6.	6.	6.	7.	7.	7.	7.	8.	8.	8.
8.	8.	9.	9.	9.	9.	9.	10.	10.	10.
10.	10.	10.	11.	11.	11.	11.	11.	11.	11.
11.	12.	12.	16.	22.	31.	41.	49.	55.	61.
65.	69.	72.	75.	77.	79.	81.	83.	84.	85.
86.	87.	88.	89.	90.	90.	91.	92.	92.	93.
93.	94.	94.	95.	95.	96.	96.	96.	97.	97.
97.	98.	98.	98.	98.	99.	99.	99.	99.	99.
100.	100.	100.	100.	100.	100.	101.	101.	101.	101.
101.	101.	101.	101.	102.	102.	102.	102.	102.	102.
102.	102.	102.	102.	105.	116.	134.	155.	175.	193.
207.	292.	332.	332.	333.	334.	337.	346.	367.	380.
391.	397.	400.	402.	404.	404.	405.	405.	409.	425.
456.	475.	491.	498.	503.	505.	507.	508.	508.	509.
501.	481.	480.	534.	645.	866.	1390.	2109.	2372.	2084.
1630.	1256.	995.	798.	667.	584.	537.	514.	496.	486.
481.	479.	478.	477.	473.	457.	427.	409.	394.	386.
381.	378.	377.	376.	375.	375.	364.	307.	235.	203.
191.	174.	155.	136.	114.	92.	74.	61.	52.	45.
40.	37.	35.	33.	32.	31.	31.	31.	31.	30.
30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
30.	30.	30.	30.	30.	30.	30.	30.		

STORAGE

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	2.	2.	2.	2.	2.	2.	2.
2.	2.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	4.	5.	6.	6.
7.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	9.	9.	9.	10.	10.	10.
10.	9.	9.	9.	9.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	7.
6.	6.	5.	4.	3.	3.	3.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.

PLATE D-20

2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.		

STAGE

779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.1	779.1	779.1
779.1	779.1	779.1	779.1	779.2	779.2	779.2	779.2	779.2	779.2
779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2
779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2
779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.3	779.3	779.3
779.3	779.3	779.3	779.3	779.4	779.5	779.7	779.8	779.9	779.9
780.0	780.0	780.1	780.1	780.2	780.2	780.2	780.2	780.2	780.3
780.3	780.3	780.3	780.3	780.3	780.3	780.3	780.3	780.4	780.4
780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.4
780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.5
780.5	780.5	780.5	780.5	780.5	780.5	780.5	780.5	780.5	780.5
780.5	780.5	780.5	780.5	780.5	780.5	780.5	780.5	780.5	780.5
780.5	780.5	780.5	780.5	780.5	780.7	781.0	781.4	781.8	782.3
782.6	782.8	782.9	782.9	782.9	782.9	782.9	782.9	782.9	782.9
783.0	783.0	783.0	783.0	783.0	783.0	783.0	783.0	783.0	783.0
783.0	783.0	783.0	783.0	783.0	783.1	783.1	783.1	783.1	783.1
783.0	783.0	783.0	783.1	783.1	783.3	783.5	783.7	783.8	783.7
783.6	783.4	783.3	783.2	783.2	783.1	783.1	783.1	783.0	783.0
783.0	783.0	783.0	783.0	783.0	783.0	783.0	783.0	783.0	783.0
782.9	782.9	782.9	782.9	782.9	782.9	782.9	782.9	782.7	782.5
782.2	781.8	781.4	781.0	780.7	780.3	780.1	779.9	779.8	779.7
779.6	779.6	779.6	779.6	779.5	779.5	779.5	779.5	779.5	779.5
779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5
779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5
779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5
779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5
779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5		

PEAK OUTFLOW IS 2372. AT TIME 15.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2372.	554.	173.	173.	49906.
CMS	67.	16.	5.	5.	1413.
INCHES		24.55	30.70	30.70	30.70
MM		623.48	779.88	779.88	779.88
AC-FT		275.	344.	344.	344.
THOUS CU M		339.	424.	424.	424.

OVF

STATION000002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

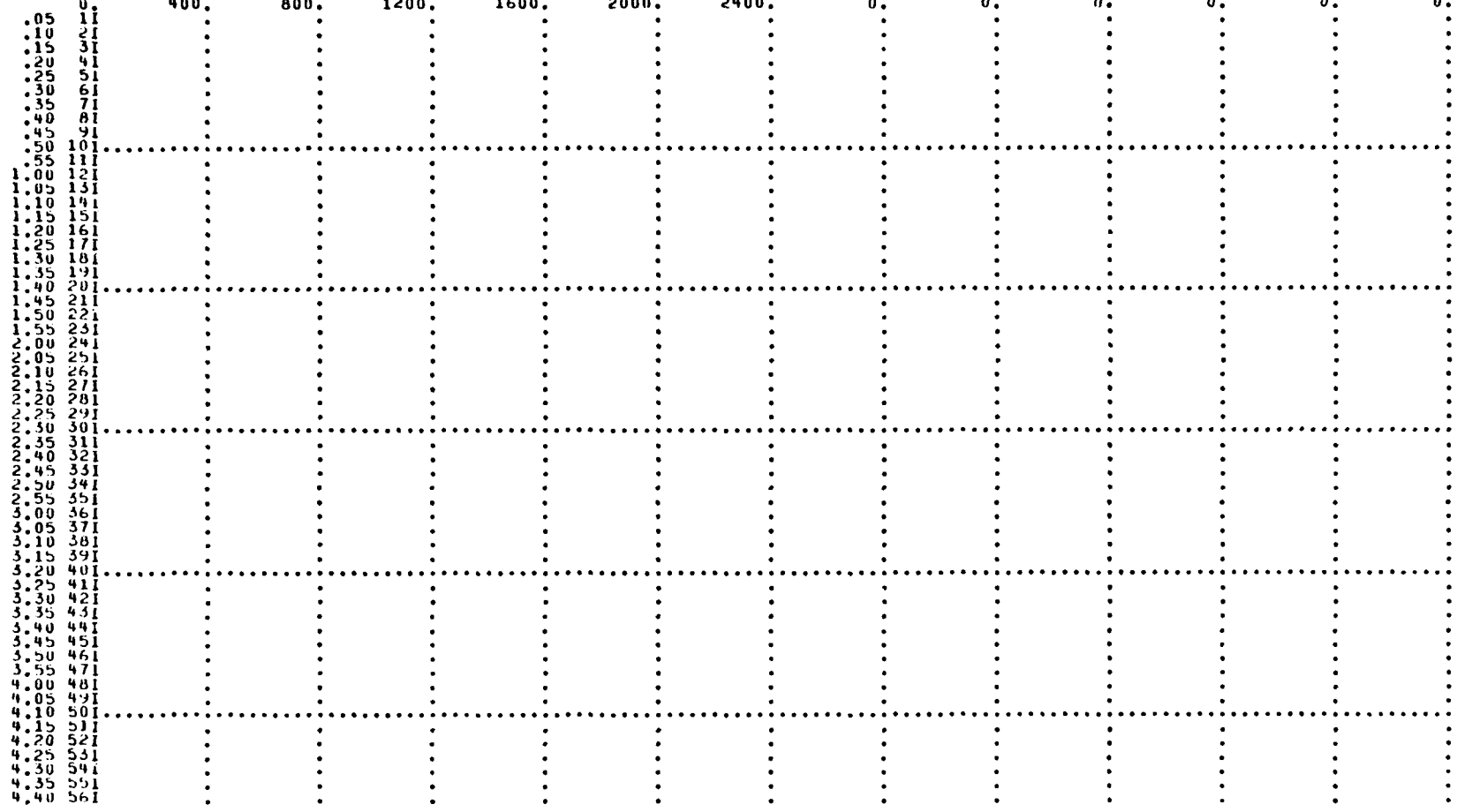


PLATE D-22

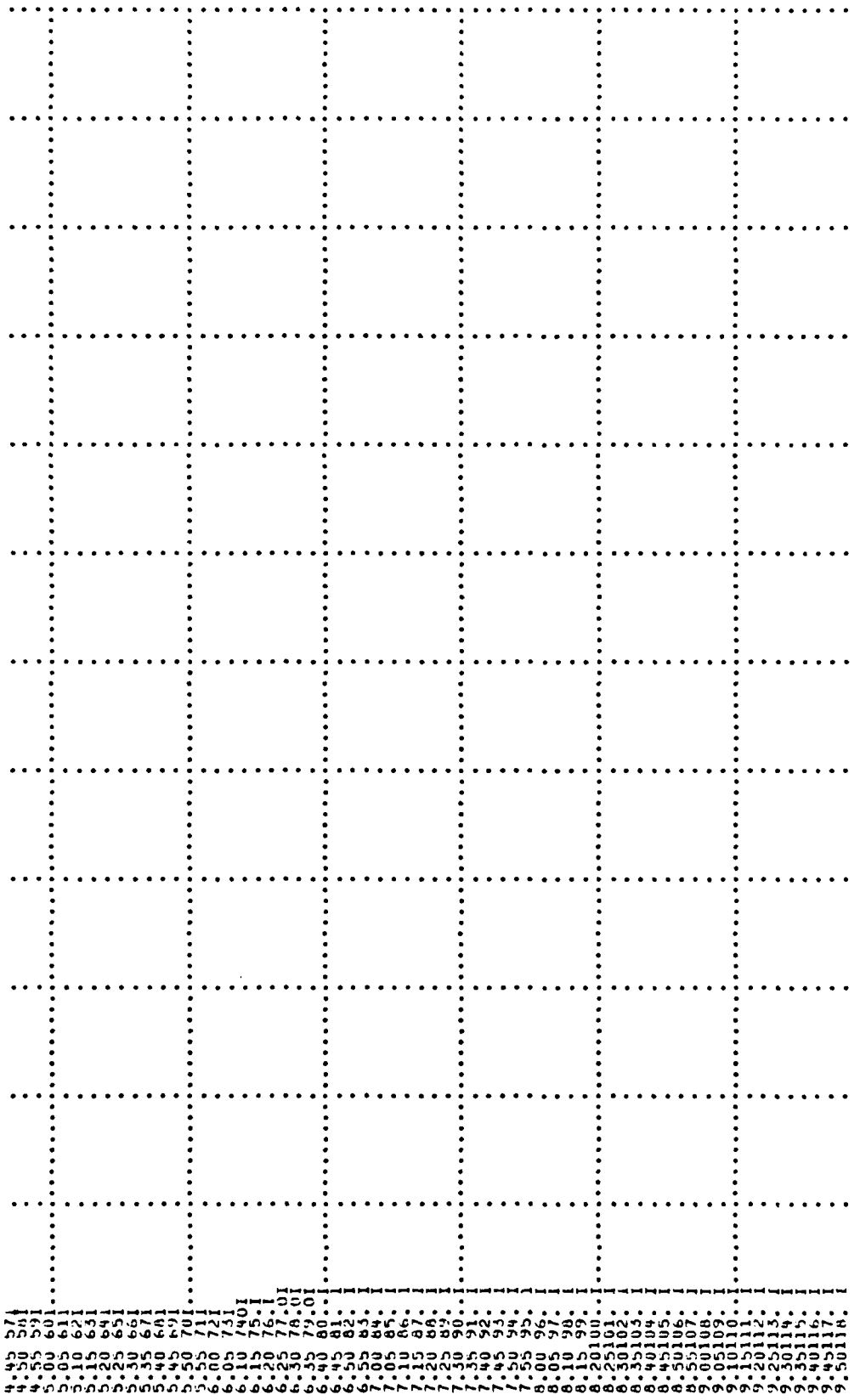


PLATE D-23

PLATE D-24

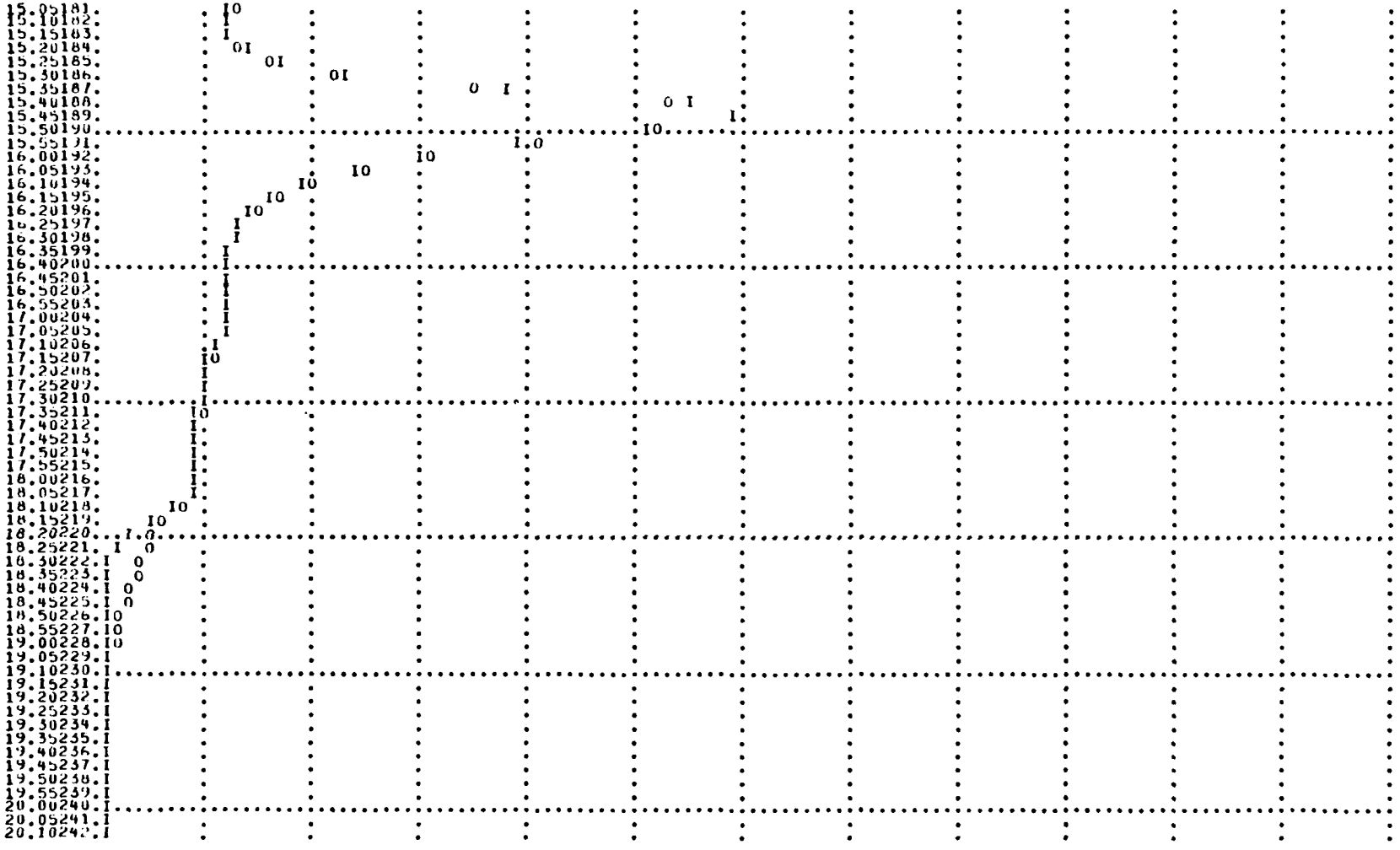


PLATE D-25

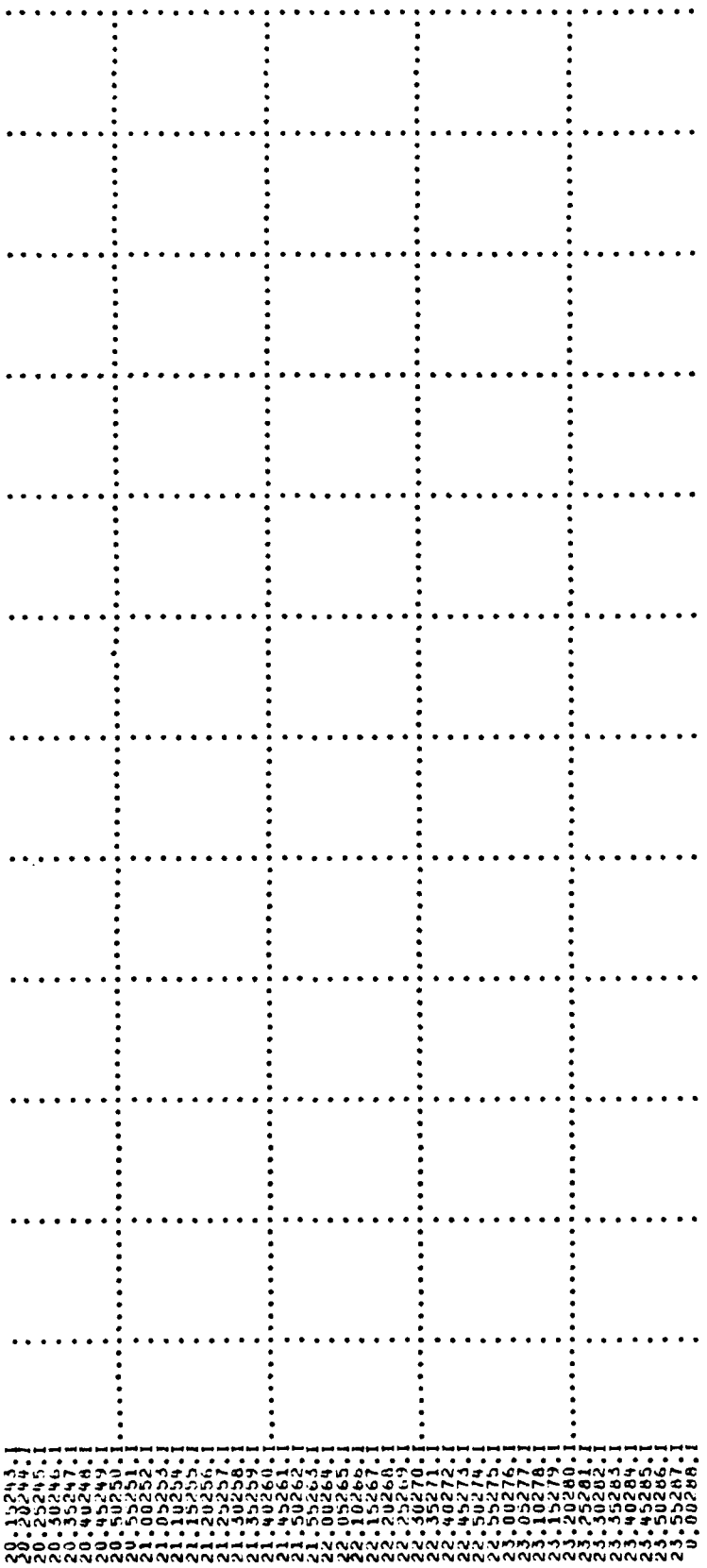


PLATE D-26

OVN

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH TO DAM EMBANKMENT

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000003	0	0	0	2	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.06	0.00	.06	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.70	102.00	121.00	150.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-90.00	0.00	0.00

CURVE NO = -90.00 WETNESS = -1.00 EFFECT CN = 90.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= .07

RECESSION DATA

STRTQ= 0.00 QRCSN= -.01 RTIOR= 1.00

TIME INCREMENT TOO LARGE--(NHQ IS GT LAG/2)

UNIT HYDROGRAPH 6 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .07 VOL= 1.00

221. 174. 50. 14. 4. 1.

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.05	145	.21	.20	.01	60.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.10	146	.21	.20	.01	85.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.15	147	.21	.20	.01	92.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.20	148	.21	.20	.00	94.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.25	149	.21	.21	.00	95.
1.01	.30	6	.01	0.00	.01	0.	1.01	12.30	150	.21	.21	.00	95.
1.01	.35	7	.01	0.00	.01	0.	1.01	12.35	151	.21	.21	.00	95.
1.01	.40	8	.01	0.00	.01	0.	1.01	12.40	152	.21	.21	.00	96.
1.01	.45	9	.01	0.00	.01	0.	1.01	12.45	153	.21	.21	.00	96.
1.01	.50	10	.01	0.00	.01	0.	1.01	12.50	154	.21	.21	.00	96.
1.01	.55	11	.01	0.00	.01	0.	1.01	12.55	155	.21	.21	.00	96.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.00	156	.21	.21	.00	96.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.05	157	.25	.25	.00	105.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.10	158	.25	.25	.00	112.
1.01	1.15	15	.01	0.00	.01	0.	1.01	13.15	159	.25	.25	.00	115.
1.01	1.20	16	.01	0.00	.01	0.	1.01	13.20	160	.25	.25	.00	115.
1.01	1.25	17	.01	0.00	.01	0.	1.01	13.25	161	.25	.25	.00	115.
1.01	1.30	18	.01	.00	.01	0.	1.01	13.30	162	.25	.25	.00	116.
1.01	1.35	19	.01	.00	.01	0.	1.01	13.35	163	.25	.25	.00	116.
1.01	1.40	20	.01	.00	.01	0.	1.01	13.40	164	.25	.25	.00	116.
1.01	1.45	21	.01	.00	.01	0.	1.01	13.45	165	.25	.25	.00	116.

PLATE D-27

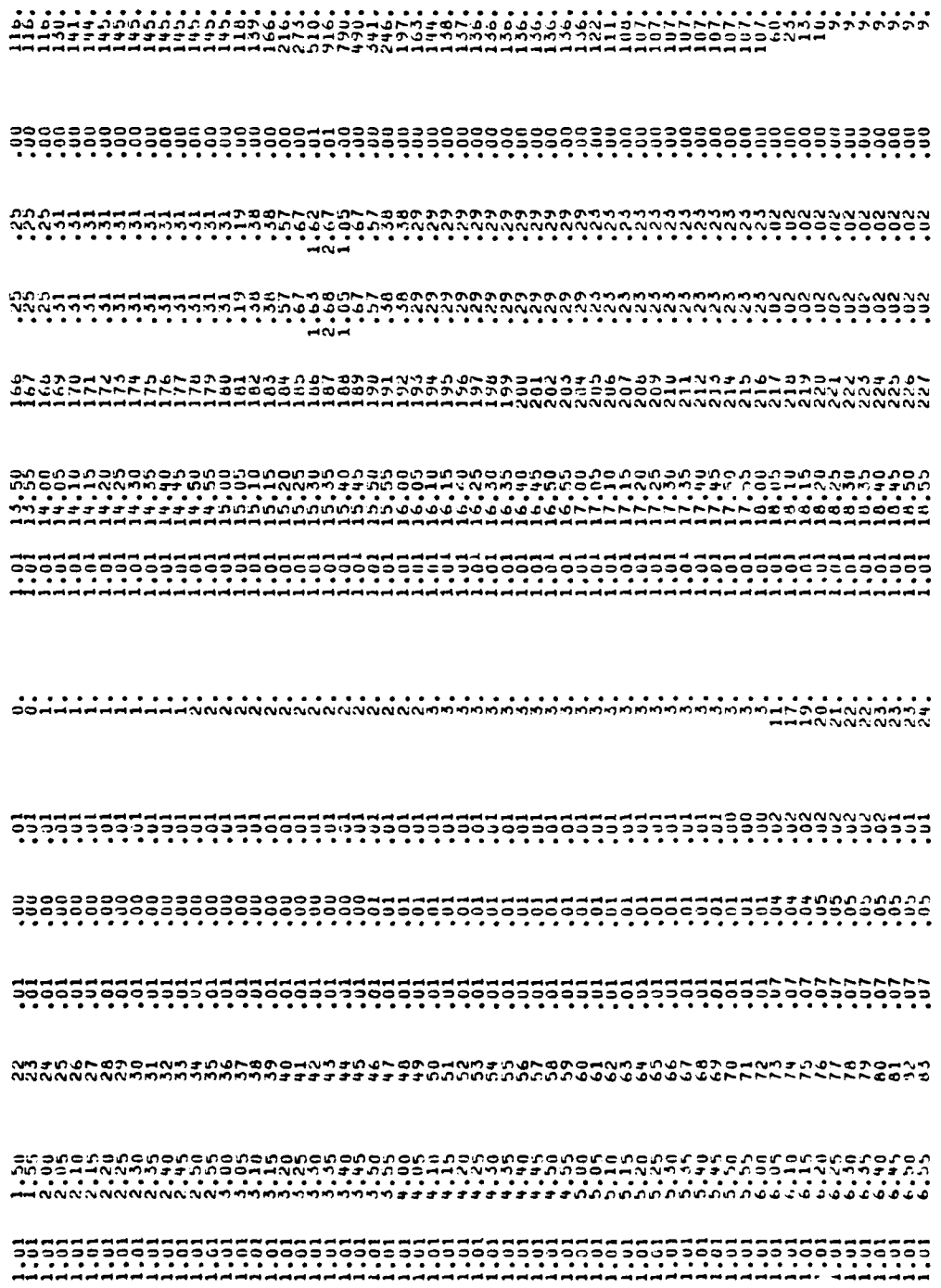


PLATE D-28

PLATE D-29

SUM 32.11 30.81 1.30 14312.
(816.)(783.)(33.)(405.47)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	916.	161.	50.	50.	14337.
CMS	26.	5.	1.	1.	406.
INCHES		24.92	30.87	30.87	30.87
MM		632.95	784.17	784.17	784.17
AC-FT		80.	99.	99.	99.
THOUS CU M		98.	122.	122.	122.

PLATE D-30

OVF

STATION000005

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

PRECIP(L) AND EXCESS(X)

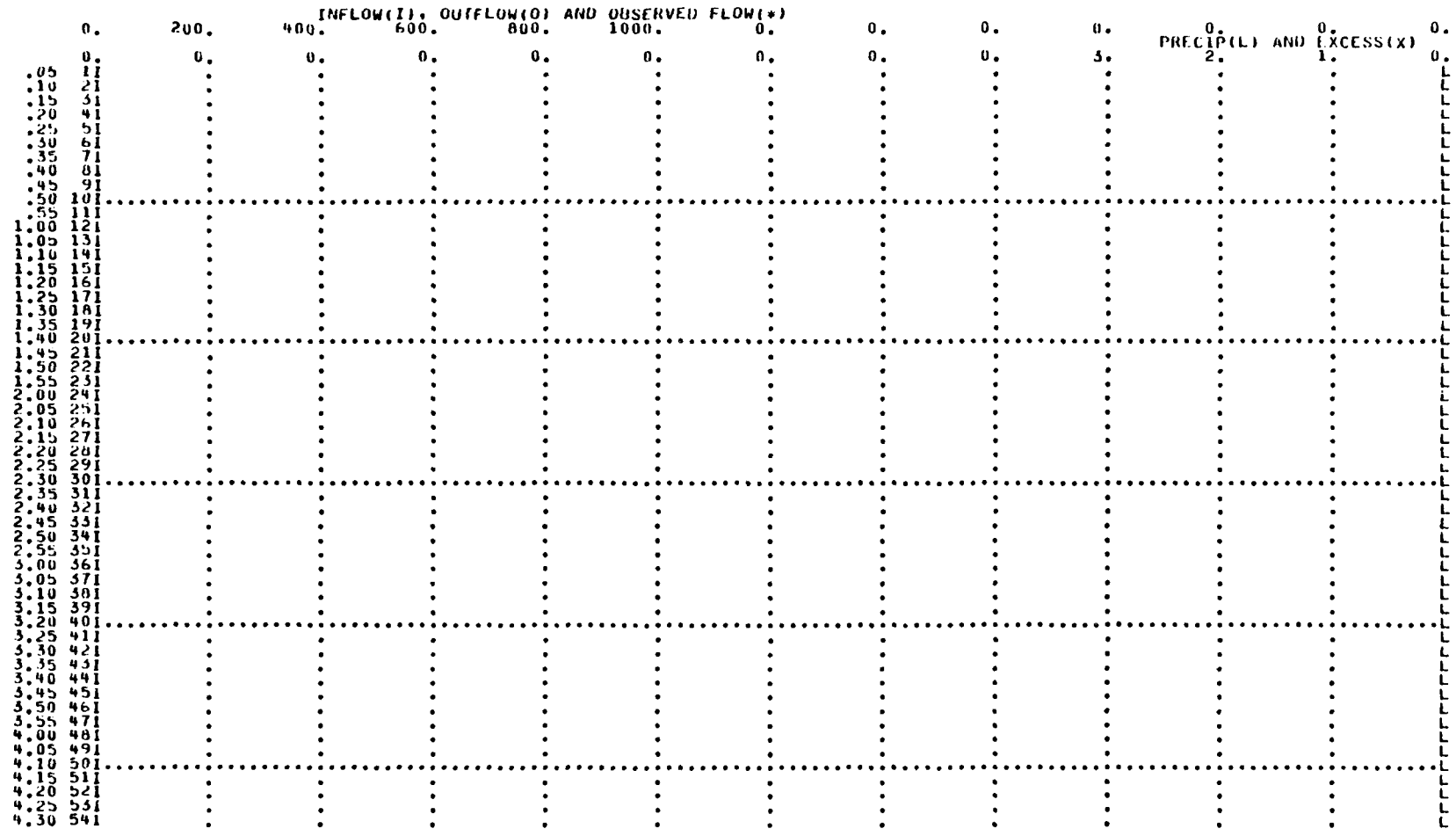


PLATE D-31

PLATE D-32

PLATE D-33

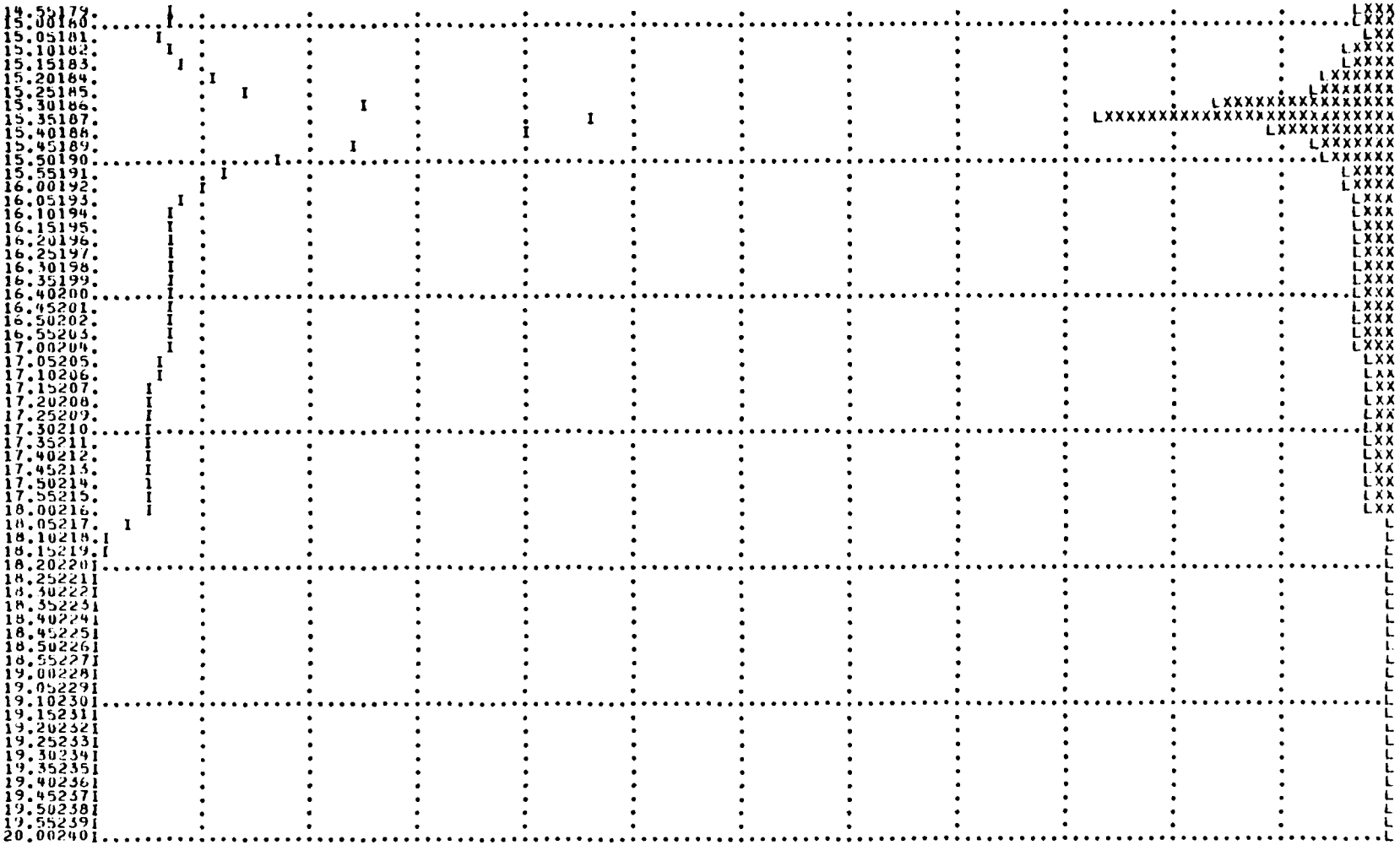
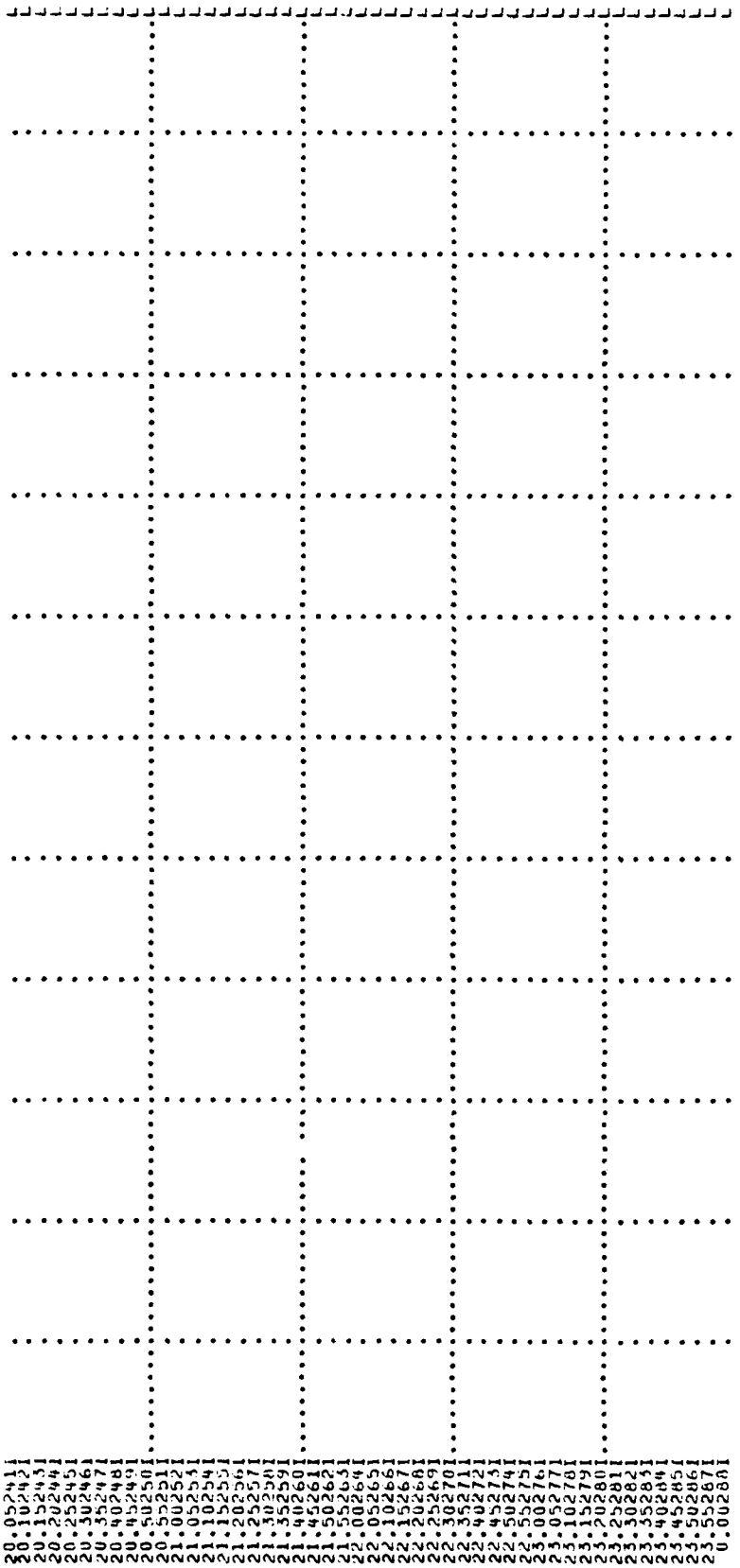


PLATE D-34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21.00241
21.05241
21.10241
21.15241
21.20241
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21.30241
21.35241
21.40241
21.45241
21.50241
21.55241
22.00241
22.05241
22.10241
22.15241
22.20241
22.25241
22.30241
22.35241
22.40241
22.45241
22.50241
22.55241
23.00241
23.05241
23.10241
23.15241
23.20241
23.25241
23.30241
23.35241
23.40241
23.45241
23.50241
23.55241
0.00241

PLATE D-35

HYDROGRAPH AT STA000003 FOR PLAN 1, RTIO 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	916.	161.	50.	50.	14337.
CMS	26.	5.	1.	1.	406.
INCHES		24.92	30.87	30.87	30.87
MM		632.95	784.17	784.17	784.17
AC-FT		80.	99.	99.	99.
THOUS CU M		98.	122.	122.	122.

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

INFLOW HYDROGRAPH TO RESERVOIR 10656

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
M 2+3	2	0	0	2	0	1	0	0

SUM OF 2 HYDROGRAPHS AT M 2+3 PLAN 1 RTIO 1 0.5 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1435.	354.	112.	112.	32127.
CMS	41.	10.	3.	3.	910.
INCHES		12.20	15.37	15.37	15.37
MM		309.89	390.48	390.48	390.48
AC-FT		176.	221.	221.	221.
THOUS CU M		217.	273.	273.	273.

OVF

STATIONM 2+3

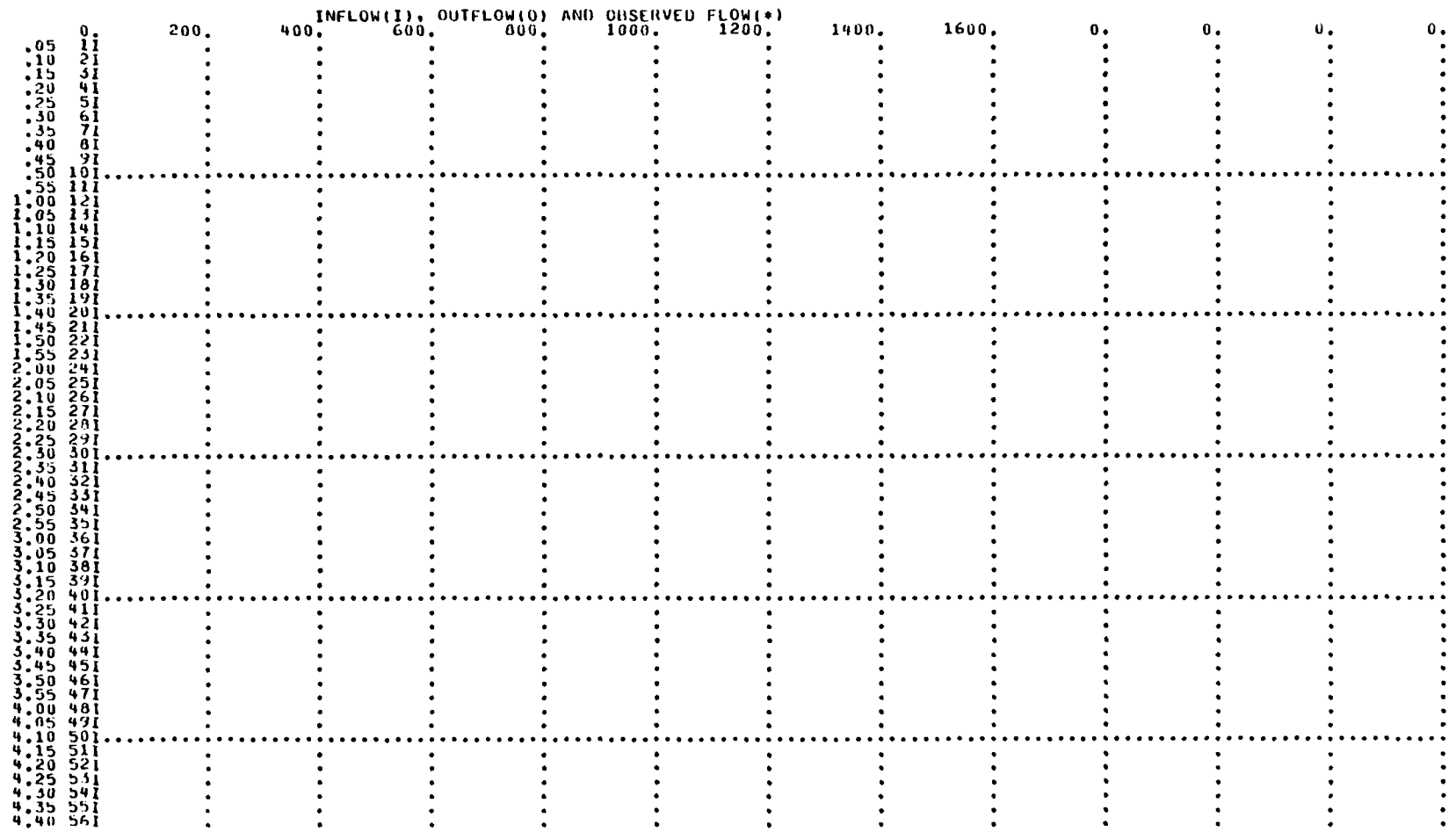

PLATE D-37

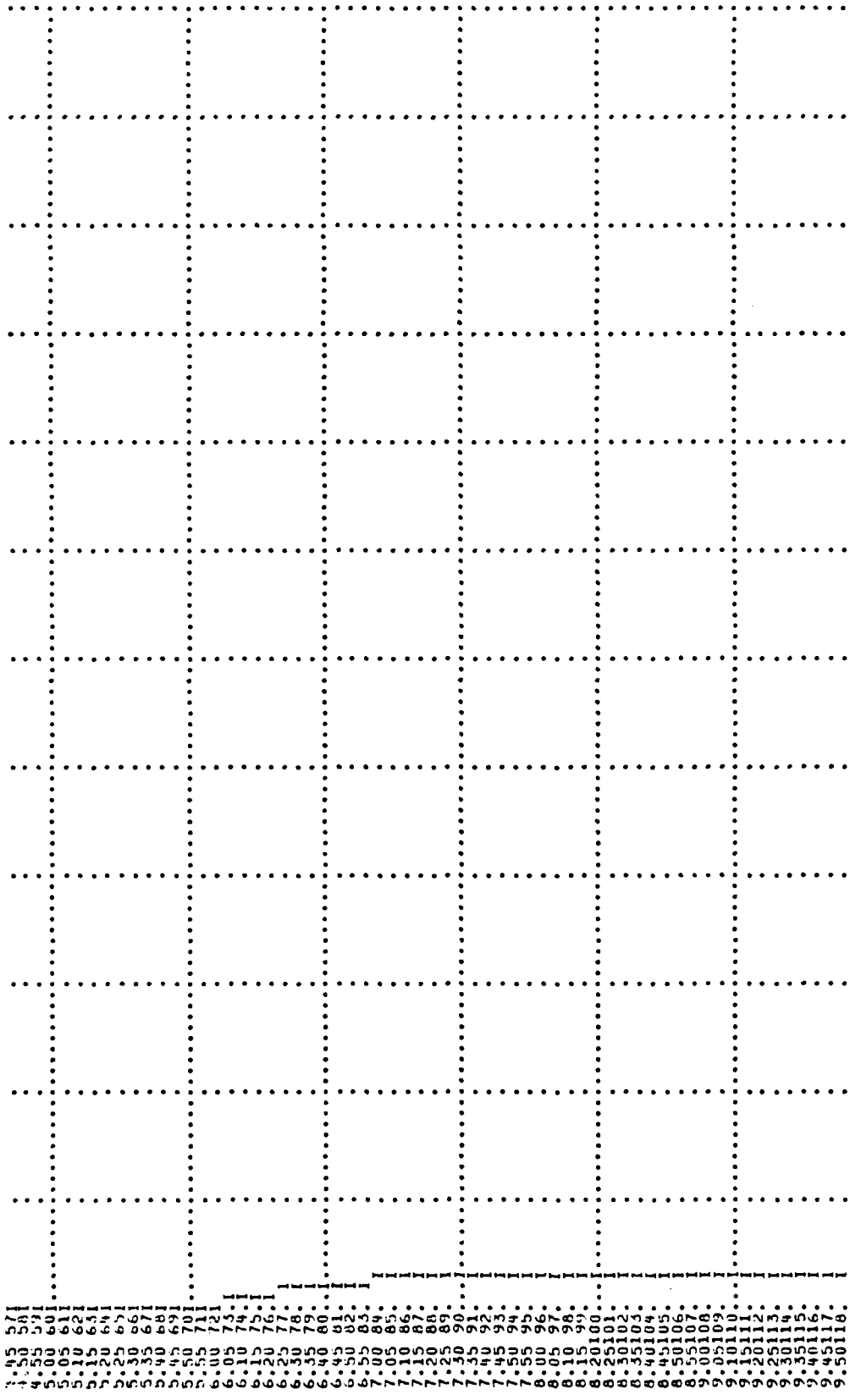

PLATE D-38

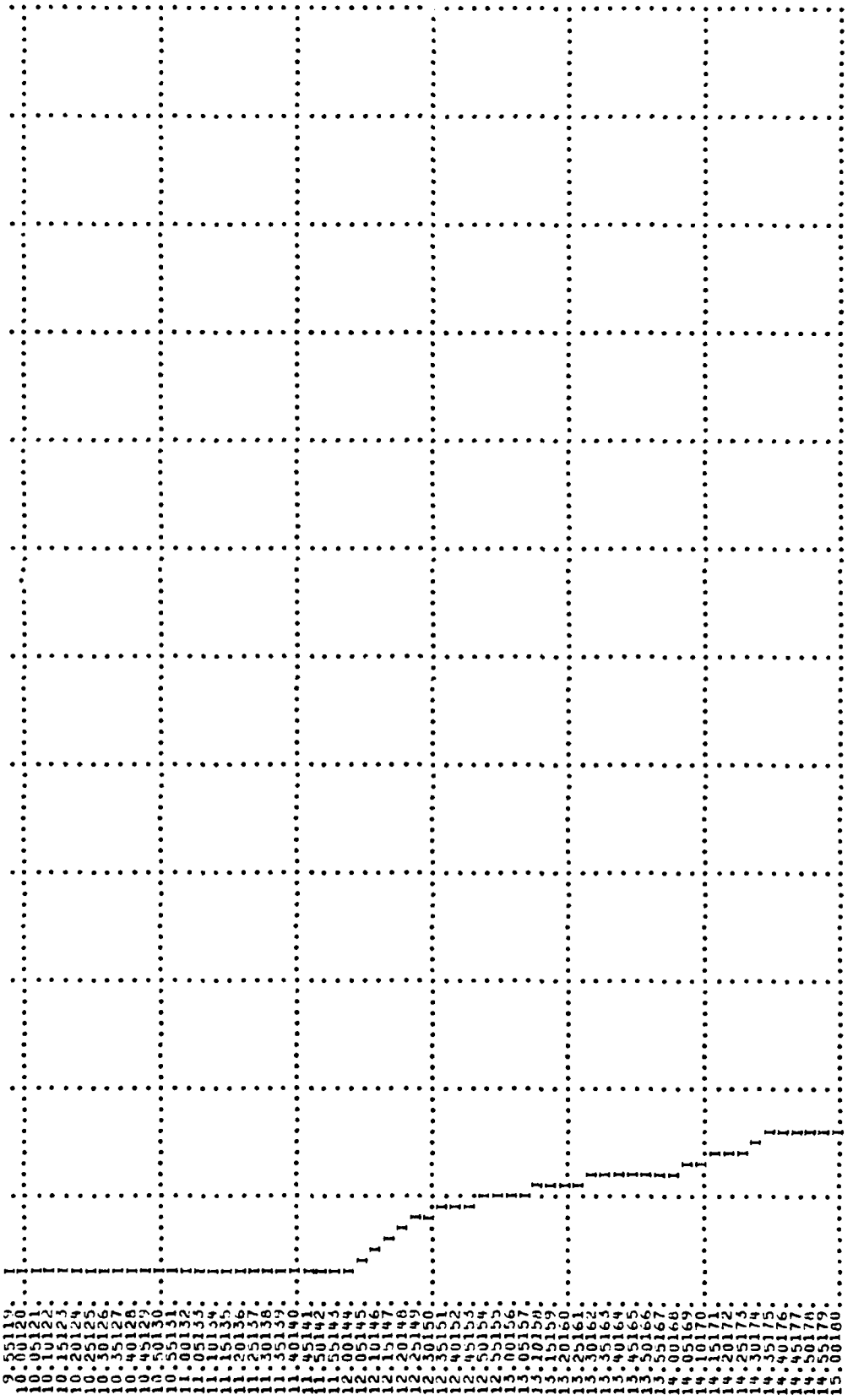

PLATE D-39

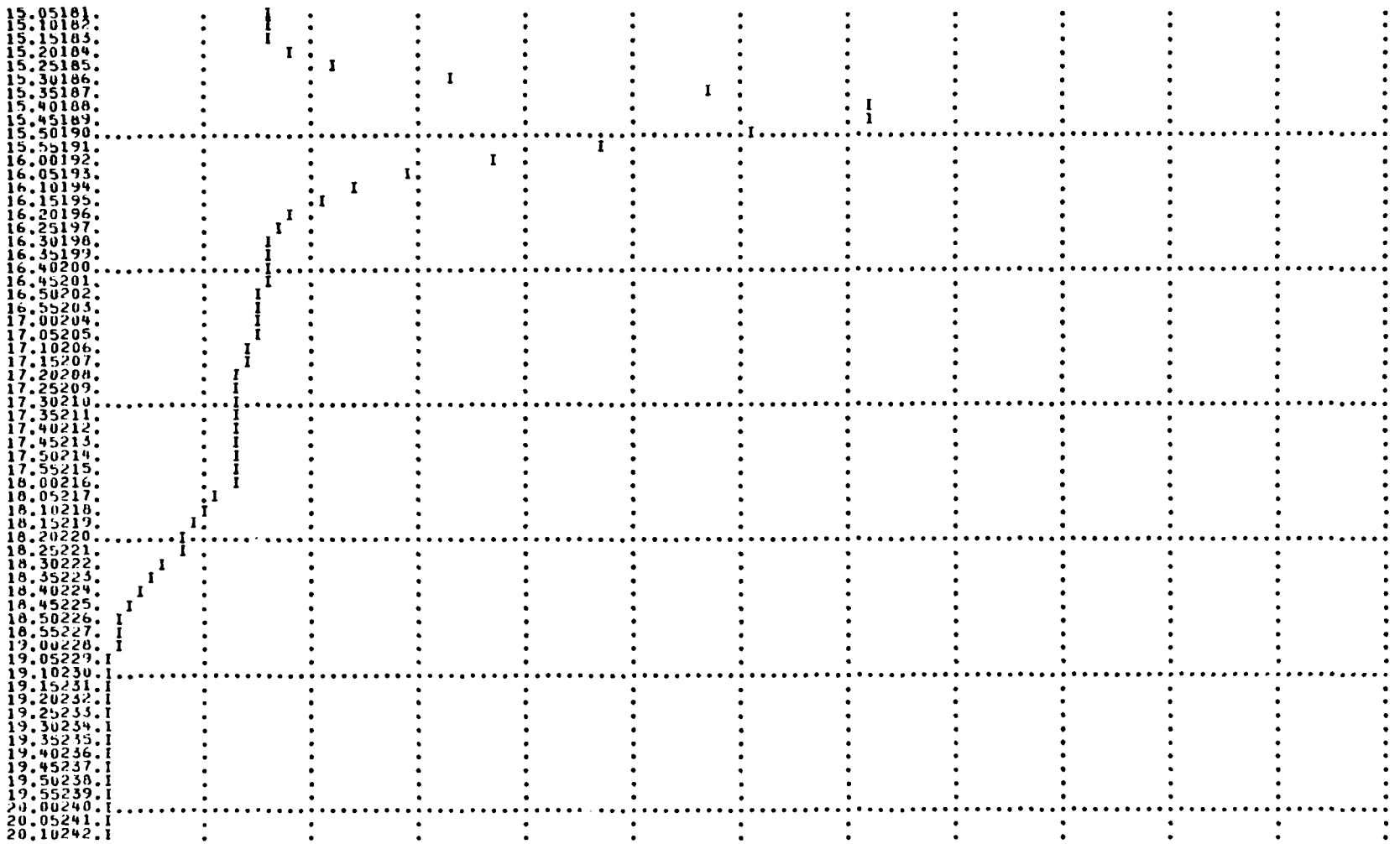
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PLATE D-40

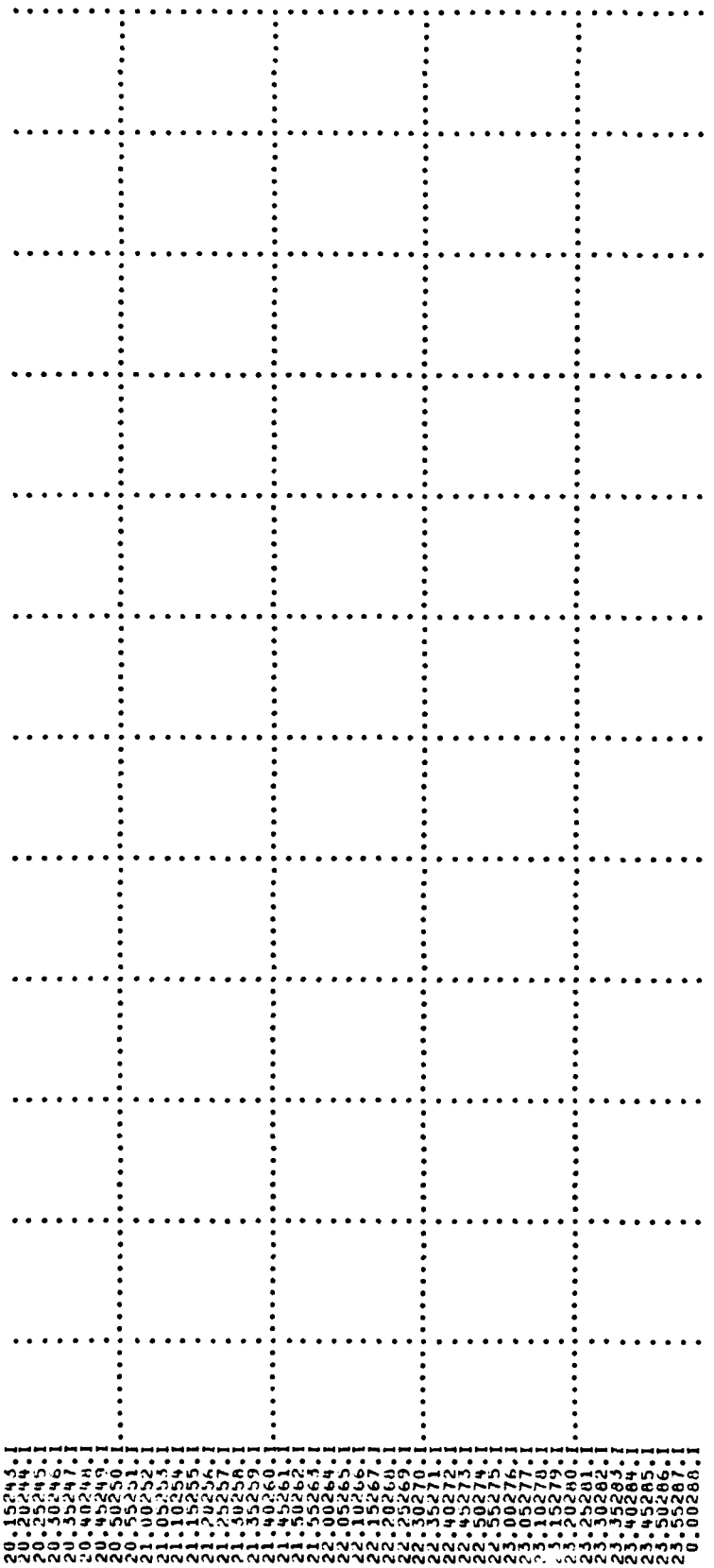

PLATE D-41

OVM

SUM OF 2 HYDROGRAPHS AT M 2+3 PLAN 1 RTIO 6 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2899.	712.	223.	223.	64243.
CMS	82.	20.	6.	6.	1819.
INCHES		24.53	30.74	30.74	30.74
MM		623.05	780.83	780.83	780.83
AC-FT		353.	442.	442.	442.
THOUS CU M		435.	546.	546.	546.

PLATE D-42

OVF

STATIONM 2+3 [PMF]

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

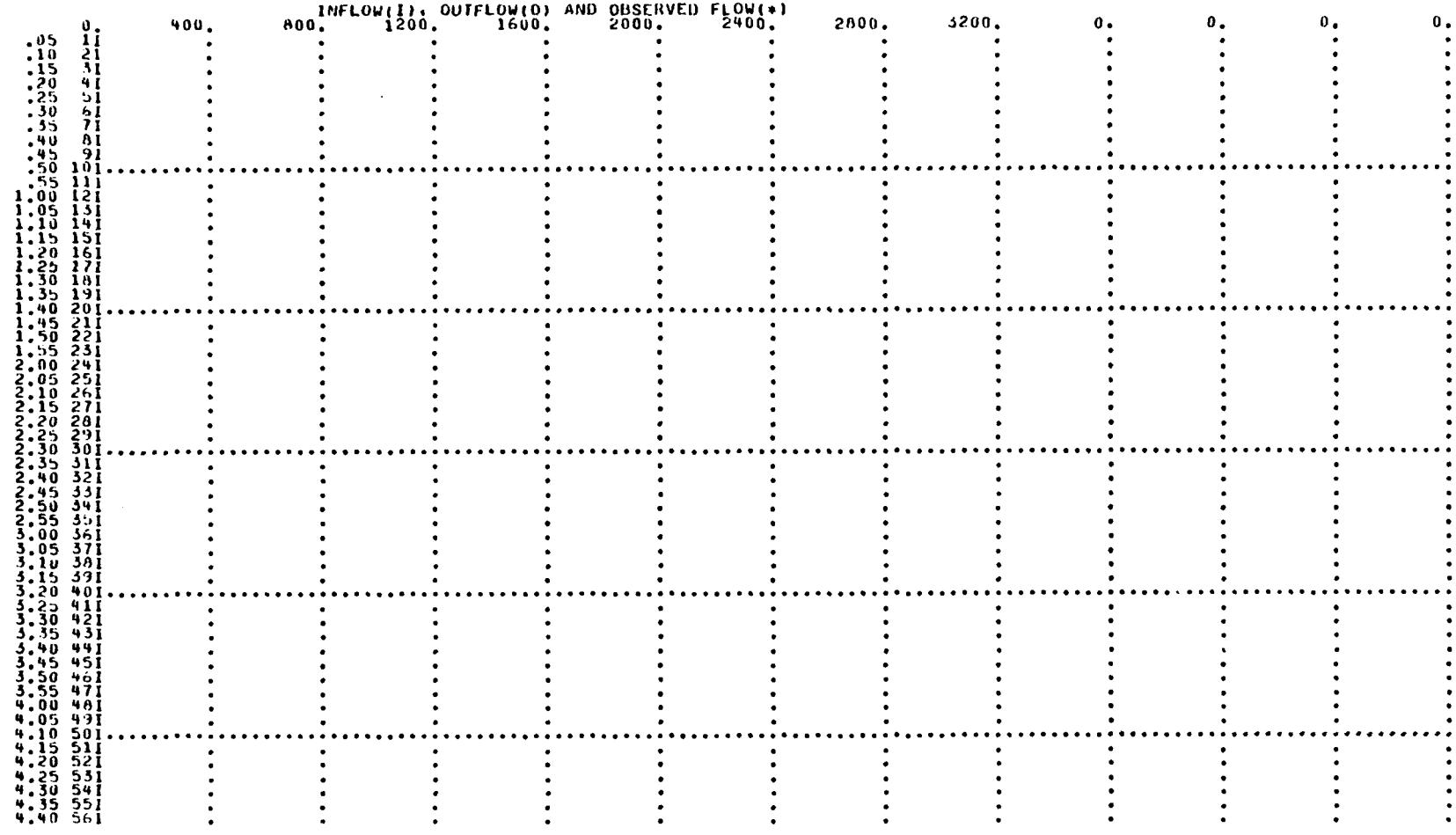

PLATE D-43

PLATE D-44

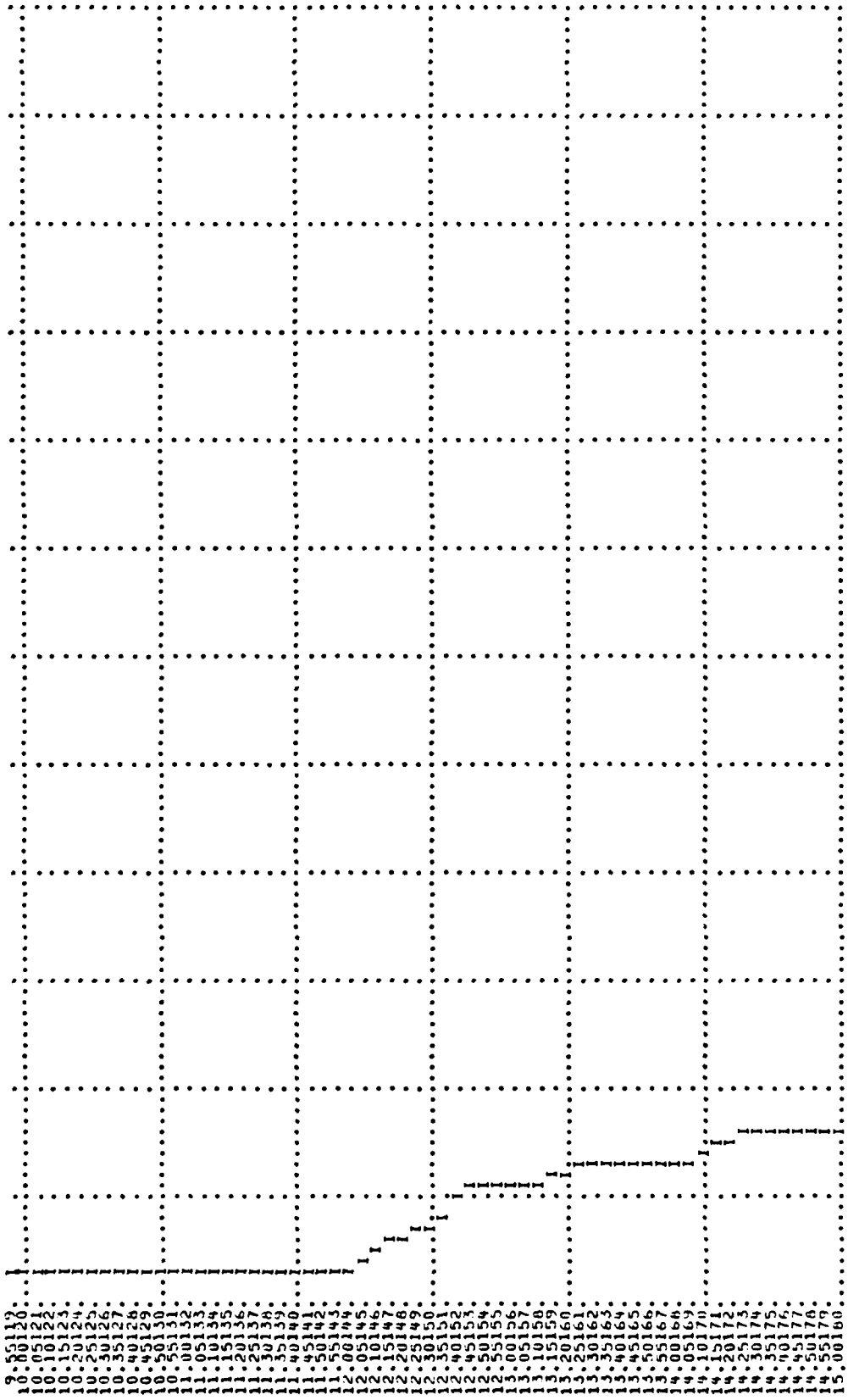

PLATE D-45

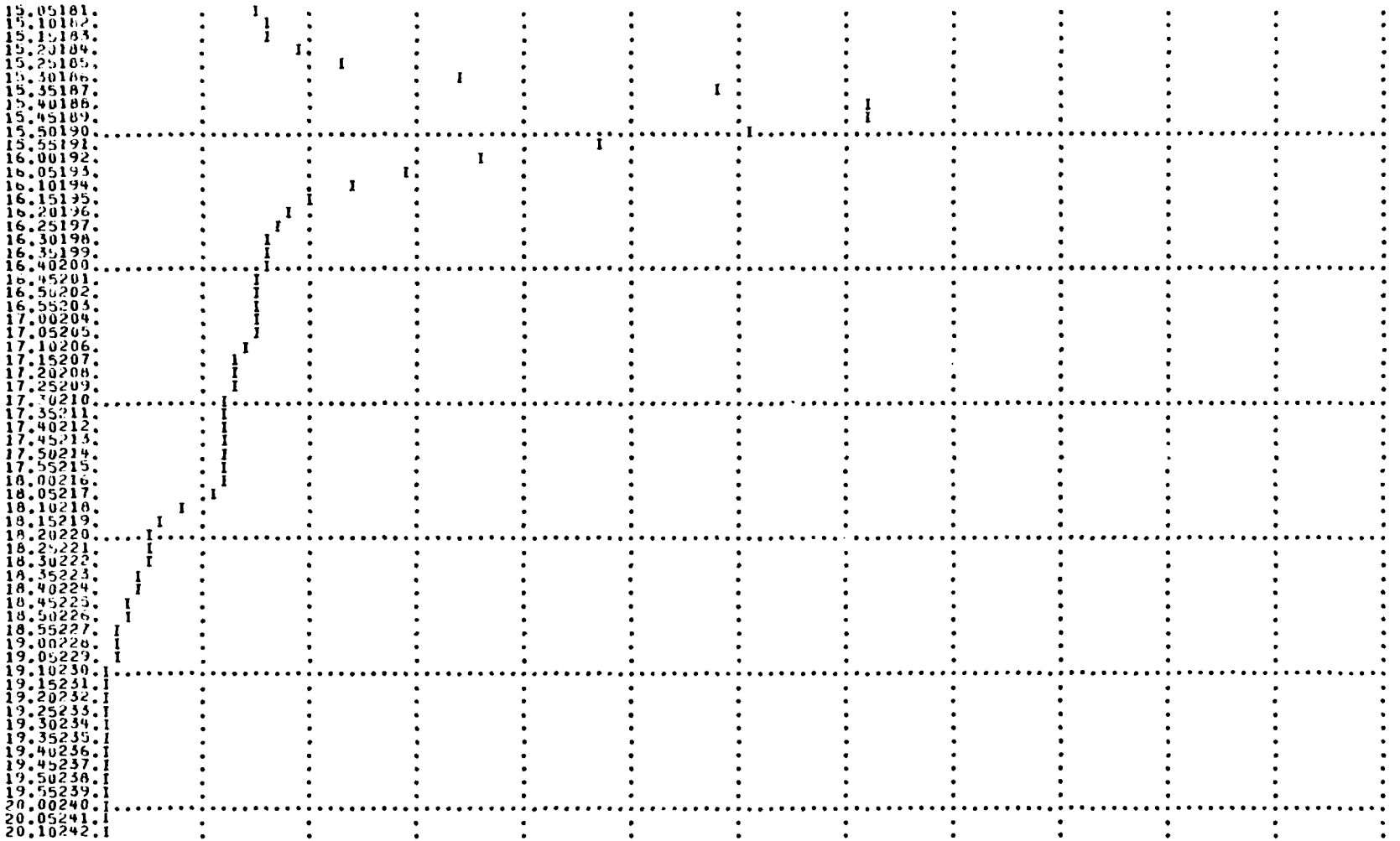

PLATE D-46


20.15243.I
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0.00288.I

PLATE D-47

OVN

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTED FLOWS THRU RESERVOIR 10656

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000004	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-779.	-1

STAGE	779.10	779.50	780.00	780.50	781.00	781.50	782.00	782.50	783.00	783.50
	784.00	785.00	786.00	787.00	788.00	789.00	790.00			
FLOW	0.00	19.60	67.90	133.20	213.70	320.10	432.60	556.70	709.30	855.10
	867.60	892.20	916.10	939.50	962.20	984.40	1006.20			
SURFACE AREA=	0.	8.	13.							
CAPACITY=	0.	42.	158.							
ELEVATION=	764.	779.	790.							

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
779.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

IOPEL	COQD	EXPD	DAMWID
785.4	2.9	1.5	1100.

CREST LENGTH AT OR BELOW ELEVATION	0.	200.	410.	530.	730.	860.	1000.
	785.4	785.6	786.0	787.0	788.0	789.0	790.0

STATION 000004, PLAN 1, RATIO 1 0.8 PMF

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	1.	1.	1.	2.	2.	2.	2.	2.
3.	3.	3.	4.	4.	5.	6.	7.	8.	9.
11.	12.	13.	15.	16.	18.	19.	21.	24.	26.
28.	30.	32.	34.	36.	38.	39.	41.	42.	44.
45.	46.	47.	48.	49.	50.	51.	52.	53.	53.
54.	55.	55.	56.	56.	57.	57.	58.	58.	59.
59.	60.	60.	60.	61.	61.	61.	61.	62.	62.
62.	62.	63.	63.	63.	63.	63.	63.	64.	64.
64.	64.	64.	64.	65.	67.	71.	76.	83.	90.

98.	106.	114.	121.	128.	135.	143.	151.	158.	166.
173.	179.	185.	191.	197.	202.	207.	213.	218.	224.
231.	237.	243.	250.	256.	262.	275.	282.	289.	294.
298.	300.	303.	310.	323.	359.	442.	583.	746.	851.
859.	858.	854.	796.	733.	668.	608.	555.	518.	485.
457.	433.	415.	398.	381.	370.	357.	344.	352.	321.
312.	304.	297.	290.	285.	280.	274.	265.	254.	243.
231.	217.	205.	192.	178.	164.	150.	137.	126.	116.
108.	99.	92.	85.	79.	73.	68.	64.	61.	58.
55.	52.	50.	48.	46.	44.	42.	40.	39.	37.
36.	35.	34.	33.	32.	31.	30.	29.	28.	28.
27.	27.	26.	26.	25.	25.	24.	24.	24.	23.
23.	23.	23.	22.	22.	22.	22.	22.	21.	21.
21.	21.	21.	21.	21.	21.	21.	21.		

STORAGE

42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
42.	42.	42.	43.	43.	43.	43.	43.	43.	43.
43.	43.	43.	43.	43.	43.	43.	44.	44.	44.
44.	44.	45.	45.	45.	45.	46.	46.	46.	46.
46.	47.	47.	47.	47.	47.	47.	48.	48.	48.
48.	48.	48.	48.	48.	48.	48.	49.	49.	49.
49.	49.	49.	49.	49.	49.	49.	49.	49.	49.
49.	49.	49.	49.	49.	49.	49.	49.	49.	49.
49.	49.	50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	51.	51.	51.
52.	53.	53.	54.	54.	54.	55.	55.	56.	56.
57.	57.	57.	58.	58.	58.	59.	59.	59.	59.
60.	60.	60.	60.	61.	61.	62.	62.	62.	62.
63.	63.	63.	63.	64.	65.	69.	74.	79.	83.
84.	84.	83.	81.	79.	77.	75.	73.	71.	70.
69.	68.	67.	67.	66.	66.	65.	64.	64.	64.
63.	63.	62.	62.	62.	62.	61.	61.	61.	60.
60.	59.	58.	58.	57.	56.	55.	55.	54.	53.
53.	52.	52.	51.	51.	50.	50.	50.	49.	49.
49.	49.	48.	48.	48.	48.	48.	48.	47.	47.
47.	47.	47.	47.	47.	47.	47.	47.	46.	46.
46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
46.	46.	46.	46.	46.	46.	46.	46.	46.	46.

STAGE

779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.1	779.1
779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1
779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1
779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.3	779.3
779.3	779.3	779.4	779.4	779.4	779.5	779.5	779.5	779.5	779.6
779.6	779.6	779.6	779.7	779.7	779.7	779.7	779.7	779.7	779.7
779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8
779.9	779.9	779.9	779.9	779.9	779.9	779.9	779.9	779.9	779.9
779.9	779.9	779.9	779.9	779.9	779.9	779.9	779.9	779.9	779.9
779.9	779.9	779.9	779.9	779.9	780.0	780.0	780.0	780.0	780.0
780.0	780.0	780.0	780.0	780.0	780.0	780.0	780.1	780.1	780.2

AD-A105 580 HOSKINS-WESTERN-SONDEREGGER INC LINCOLN NE F/G 13/13
NATIONAL DAM SAFETY PROGRAM. BLACKBURN POND DAM (MO 10656), MIS--ETC(U)
JUL 80 R S DECKER, G JAMISON, G ULMER DACW43-80-C-0071
UNCLASSIFIED NL

780.2	780.3	780.3	780.4	780.5	780.5	780.6	780.6	780.7	780.7
780.7	780.8	780.8	780.9	780.9	780.9	781.0	781.0	781.0	781.0
781.1	781.1	781.1	781.2	781.2	781.2	781.3	781.3	781.4	781.4
781.4	781.4	781.4	781.5	781.5	781.7	782.0	782.6	783.1	783.5
783.6	783.6	783.5	783.3	783.1	782.9	782.7	782.5	782.3	782.2
782.1	782.0	781.9	781.8	781.8	781.7	781.7	781.6	781.6	781.5
781.5	781.4	781.4	781.4	781.3	781.3	781.3	781.2	781.2	781.1
781.1	781.0	780.9	780.9	780.8	780.7	780.6	780.5	780.4	780.4
780.3	780.2	780.2	780.1	780.1	780.0	780.0	780.0	779.9	779.9
779.9	779.8	779.8	779.8	779.8	779.7	779.7	779.7	779.7	779.7
779.7	779.7	779.6	779.6	779.6	779.6	779.6	779.6	779.6	779.6
779.6	779.6	779.6	779.6	779.6	779.6	779.5	779.5	779.5	779.5
779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5
779.5	779.5	779.5	779.5	779.5	779.5	779.5	779.5		

PEAK OUTFLOW IS 859. AT TIME 15.92 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	859.	344.	109.	109.	31506.
CMS	24.	10.	3.	3.	892.
INCHES		11.85	15.08	15.08	15.08
MM		301.04	382.93	382.93	382.93
AC-FT		171.	217.	217.	217.
THOUS CU M		210.	268.	268.	268.

OVF

STATION000004

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

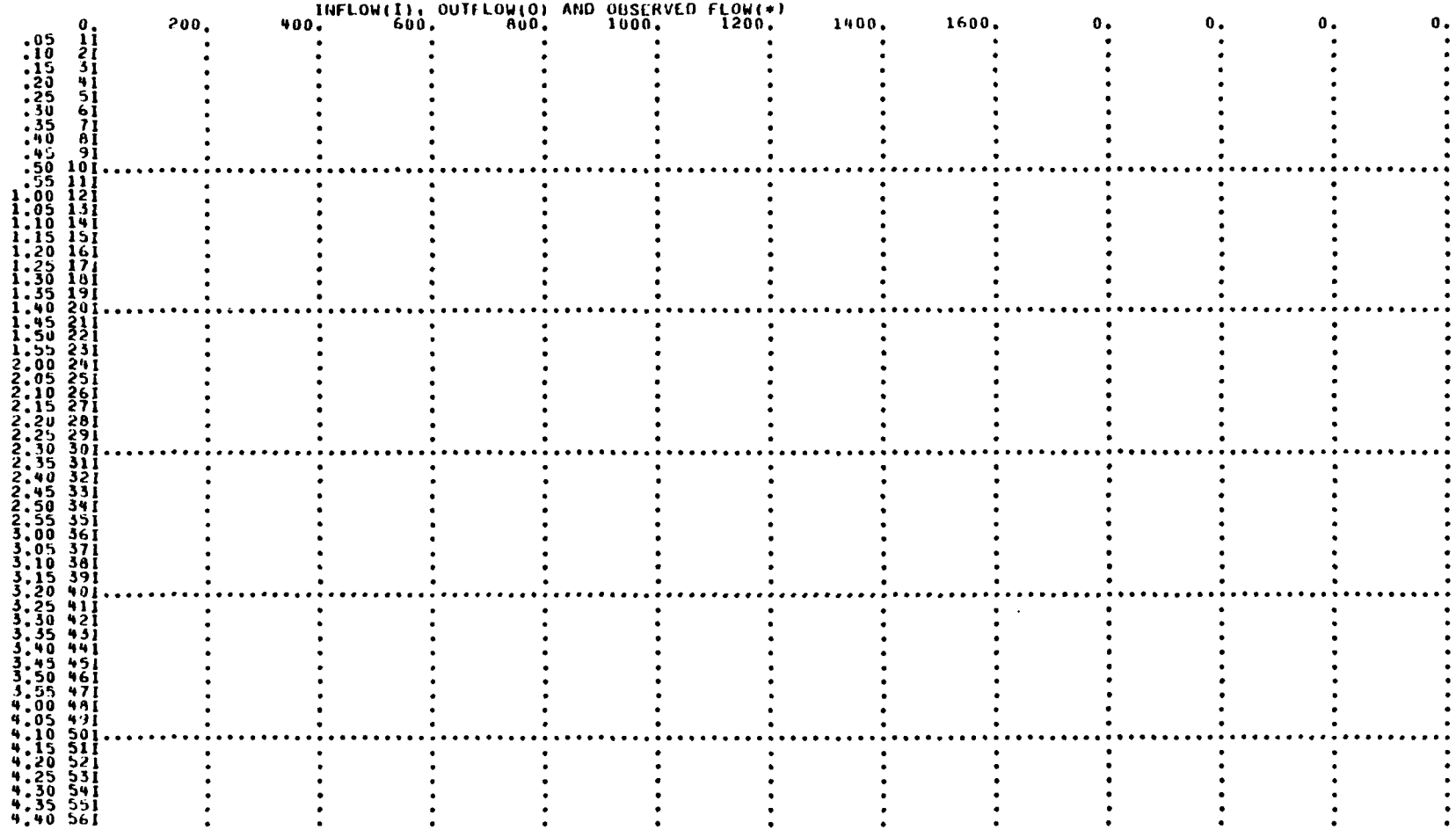


PLATE D-51


4.45 57I
4.50 58I
4.55 59I
5.00 60I
5.05 61I
5.10 62I
5.15 63I
5.20 64I
5.25 65I
5.30 66I
5.35 67I
5.40 68I
5.45 69I
5.50 70I
5.55 71I
6.00 72I
6.05 730I
6.10 740I
6.15 750I
6.20 760I
6.25 770 I
6.30 780 I
6.35 790 I
6.40 800.I
6.45 81.0I
6.50 82.0I
6.55 83.0I
7.00 84.0 I
7.05 85.0 I
7.10 86.0 I
7.15 87.0 I
7.20 88.0 I
7.25 89.0 I
7.30 90.0.I
7.35 91.0 I
7.40 92. 0I
7.45 93. 0I
7.50 94. 0I
7.55 95. 0I
8.00 96. 0I
8.05 97. 0I
8.10 98. 0I
8.15 99. 0I
8.20100..0I
8.25101. 0I
8.30102. 0I
8.35103. 0I
8.40104. 0I
8.45105. 0I
8.50106. I
8.55107. I
9.00108. I
9.05109. I
9.10110...I
9.15111. I
9.20112. I
9.25113. I
9.30114. I
9.35115. I
9.40116. I
9.45117. I
9.50118. I

PLATE D-52

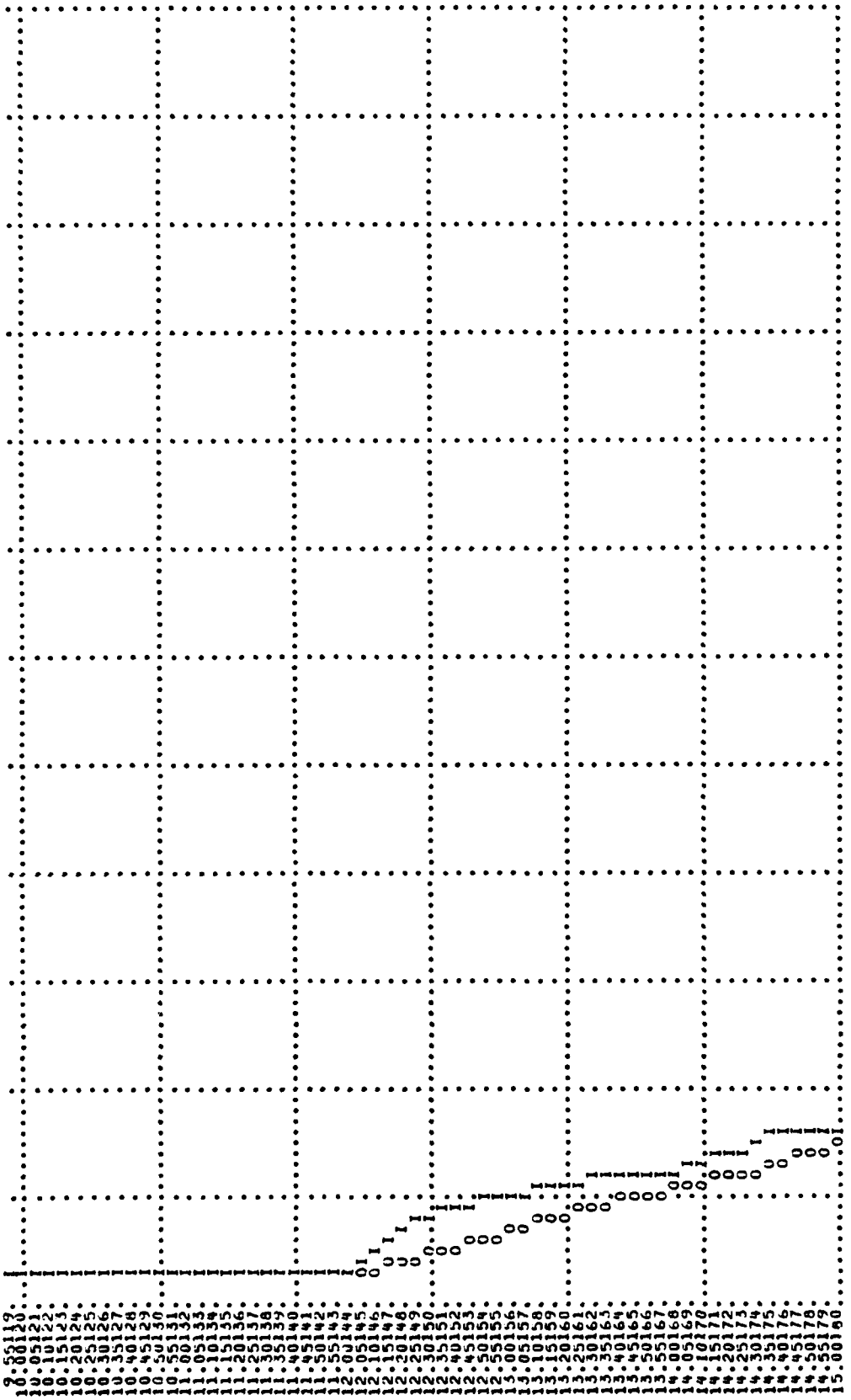


PLATE D-53

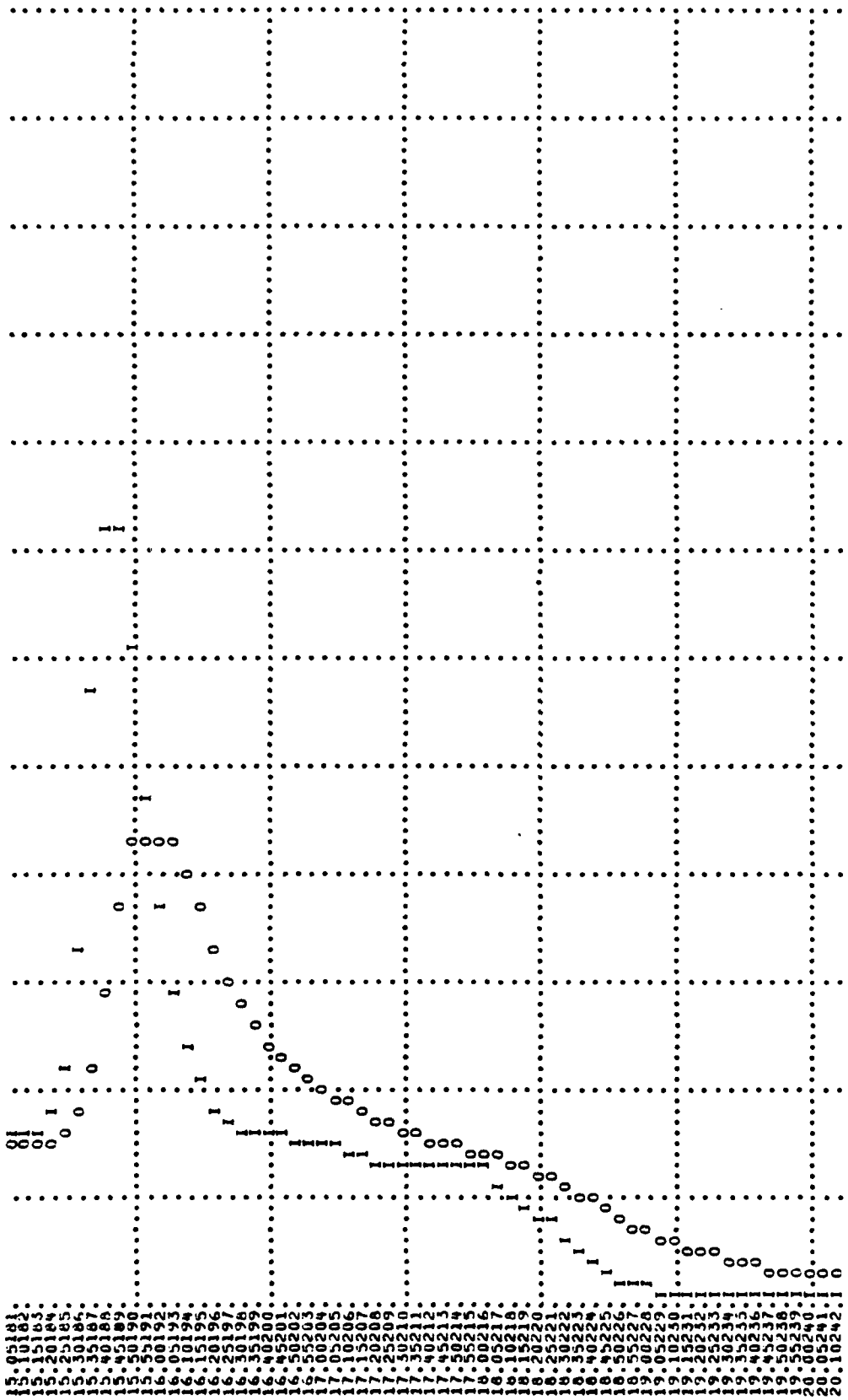


PLATE D-54

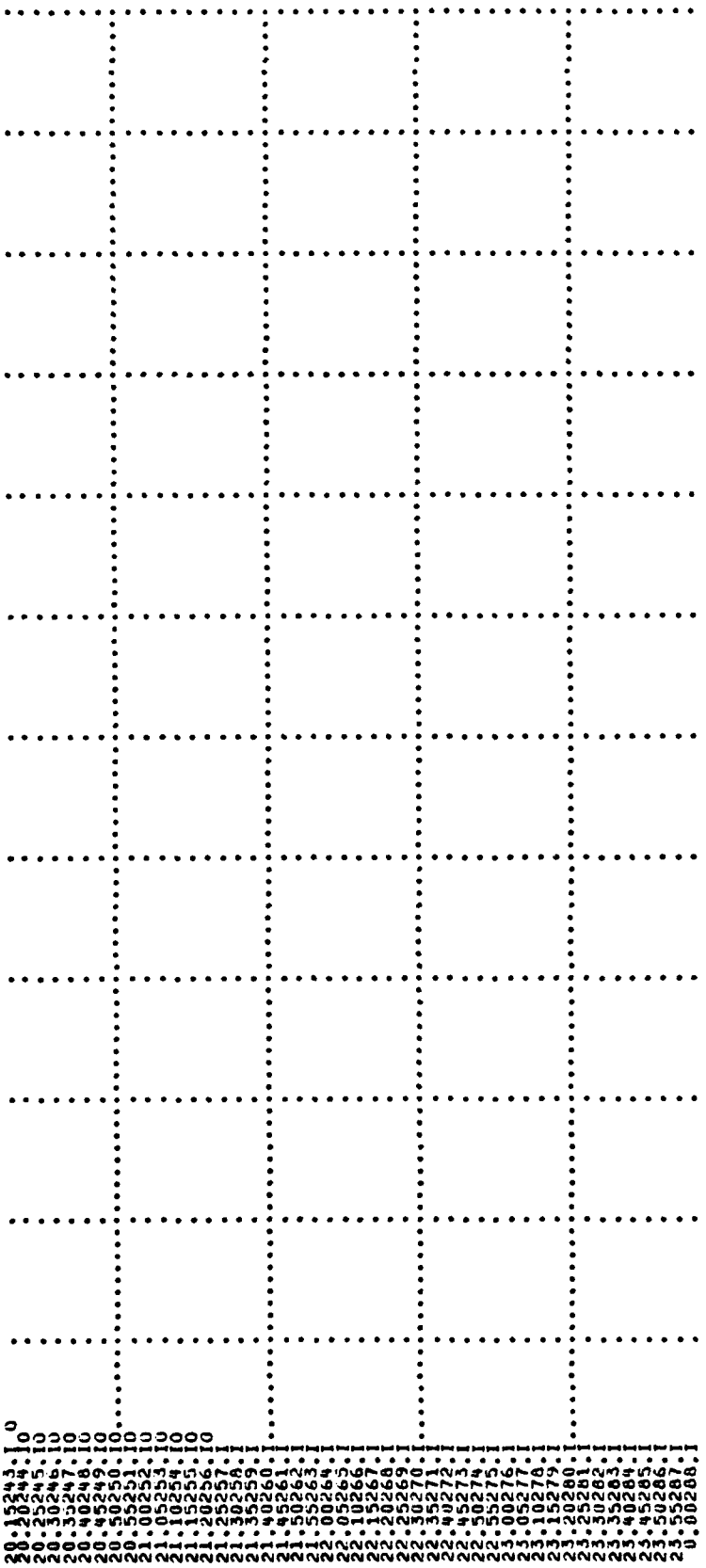


PLATE D-55

OVN

STATION 000004, PLAN 1, RATIO 6 PMF

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
1.	2.	2.	3.	3.	3.	4.	4.	4.	5.
5.	5.	6.	6.	6.	7.	7.	7.	7.	8.
8.	8.	9.	9.	11.	12.	14.	16.	18.	21.
26.	31.	36.	40.	45.	49.	53.	57.	61.	65.
68.	73.	77.	80.	84.	87.	90.	93.	95.	98.
100.	102.	104.	106.	107.	109.	110.	112.	113.	114.
115.	116.	117.	118.	119.	120.	120.	121.	122.	122.
123.	123.	124.	124.	125.	125.	126.	126.	126.	127.
127.	127.	128.	128.	128.	128.	129.	129.	129.	129.
130.	130.	130.	130.	132.	138.	146.	157.	169.	182.
195.	212.	241.	268.	292.	312.	331.	349.	368.	386.
403.	419.	434.	448.	459.	469.	478.	485.	492.	502.
515.	530.	546.	562.	579.	592.	604.	613.	621.	628.
629.	628.	629.	642.	679.	766.	865.	893.	1337.	2226.
2169.	1802.	1475.	1231.	1069.	968.	916.	902.	898.	894.
889.	885.	881.	877.	872.	868.	862.	857.	810.	7[illegible]
705.	663.	628.	600.	577.	559.	541.	515.	478.	43
402.	370.	340.	312.	286.	260.	235.	212.	195.	17
165.	151.	139.	128.	120.	112.	105.	99.	93.	88.
83.	79.	75.	72.	68.	66.	64.	62.	61.	59.
58.	56.	55.	54.	53.	52.	51.	50.	49.	48.
48.	47.	47.	46.	45.	45.	45.	44.	44.	43.
43.	43.	43.	42.	42.	42.	42.	42.	41.	41.
41.	41.	41.	41.	41.	40.	40.	40.		

STORAGE

42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
42.	42.	42.	42.	42.	42.	42.	42.	42.	43.
43.	43.	43.	43.	43.	43.	43.	43.	43.	43.
43.	43.	43.	43.	43.	43.	44.	44.	44.	44.
44.	44.	44.	44.	44.	44.	45.	45.	45.	46.
46.	47.	47.	48.	48.	48.	49.	49.	49.	50.
50.	50.	51.	51.	51.	51.	51.	52.	52.	52.
52.	52.	52.	53.	53.	53.	53.	53.	53.	53.
53.	53.	53.	53.	53.	53.	54.	54.	54.	54.
54.	54.	54.	54.	54.	54.	54.	54.	54.	54.
54.	54.	54.	54.	54.	54.	54.	54.	54.	54.
54.	54.	54.	54.	54.	55.	55.	56.	56.	57.
58.	59.	60.	61.	62.	63.	64.	65.	65.	66.
67.	68.	68.	69.	69.	70.	70.	70.	70.	71.
71.	72.	73.	73.	74.	74.	74.	75.	75.	75.
75.	75.	75.	76.	77.	80.	87.	99.	111.	117.
117.	114.	112.	110.	108.	106.	105.	103.	101.	99.
97.	96.	94.	92.	90.	88.	86.	84.	81.	79.
78.	76.	75.	74.	74.	73.	72.	71.	70.	68.
67.	66.	64.	63.	62.	61.	60.	59.	58.	57.
56.	55.	55.	54.	53.	53.	53.	52.	52.	51.

51.	51.	50.	50.	50.	50.	50.	49.	49.	49.
49.	49.	49.	49.	49.	49.	48.	48.	48.	48.
48.	48.	48.	48.	48.	48.	48.	48.	48.	48.
48.	48.	48.	48.	48.	48.	48.	48.		
48.	48.	48.	48.	48.	48.	48.	48.		

STAGE

779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0
779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1	779.1
779.1	779.1	779.1	779.2	779.2	779.2	779.2	779.2	779.2	779.2
779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.2	779.3	779.3
779.3	779.3	779.3	779.3	779.3	779.3	779.4	779.4	779.5	779.5
779.6	779.6	779.7	779.7	779.8	779.8	779.8	779.9	779.9	780.0
780.0	780.0	780.1	780.1	780.1	780.1	780.2	780.2	780.2	780.2
780.2	780.3	780.3	780.3	780.3	780.3	780.3	780.3	780.3	780.4
780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.4
780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.4	780.5
780.5	780.5	780.5	780.5	780.5	780.5	780.5	780.5	780.5	780.5
780.5	780.5	780.5	780.5	780.5	780.5	780.6	780.6	780.7	780.8
780.9	781.0	781.1	781.3	781.4	781.5	781.5	781.6	781.7	781.8
781.9	781.9	782.0	782.1	782.1	782.1	782.2	782.2	782.2	782.3
782.3	782.4	782.5	782.5	782.6	782.6	782.7	782.7	782.7	782.7
782.7	782.7	782.7	782.8	782.9	783.2	783.9	785.0	786.1	786.6
786.6	786.4	786.2	786.0	785.9	785.7	785.6	785.4	785.2	785.1
784.9	784.7	784.5	784.4	784.2	784.0	783.8	783.6	783.3	783.1
783.0	782.8	782.7	782.6	782.6	782.5	782.4	782.3	782.2	782.0
781.9	781.7	781.6	781.5	781.3	781.2	781.1	781.0	780.9	780.8
780.7	780.6	780.5	780.5	780.4	780.3	780.3	780.2	780.2	780.2
780.1	780.1	780.1	780.0	780.0	780.0	780.0	779.9	779.9	779.9
779.9	779.9	779.9	779.9	779.8	779.8	779.8	779.8	779.8	779.8
779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.8	779.7
779.7	779.7	779.7	779.7	779.7	779.7	779.7	779.7	779.7	779.7
779.7	779.7	779.7	779.7	779.7	779.7	779.7	779.7		

PEAK OUTFLOW IS 2226. AT TIME 15.83 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2226.	698.	220.	220.	63369.
CMS	63.	20.	6.	6.	1794.
INCHES		24.05	30.32	30.32	30.32
MM		610.94	770.21	770.21	770.21
AC-FT		346.	436.	436.	436.
THOUS CU M		427.	538.	538.	538.

OVF

STATION000004

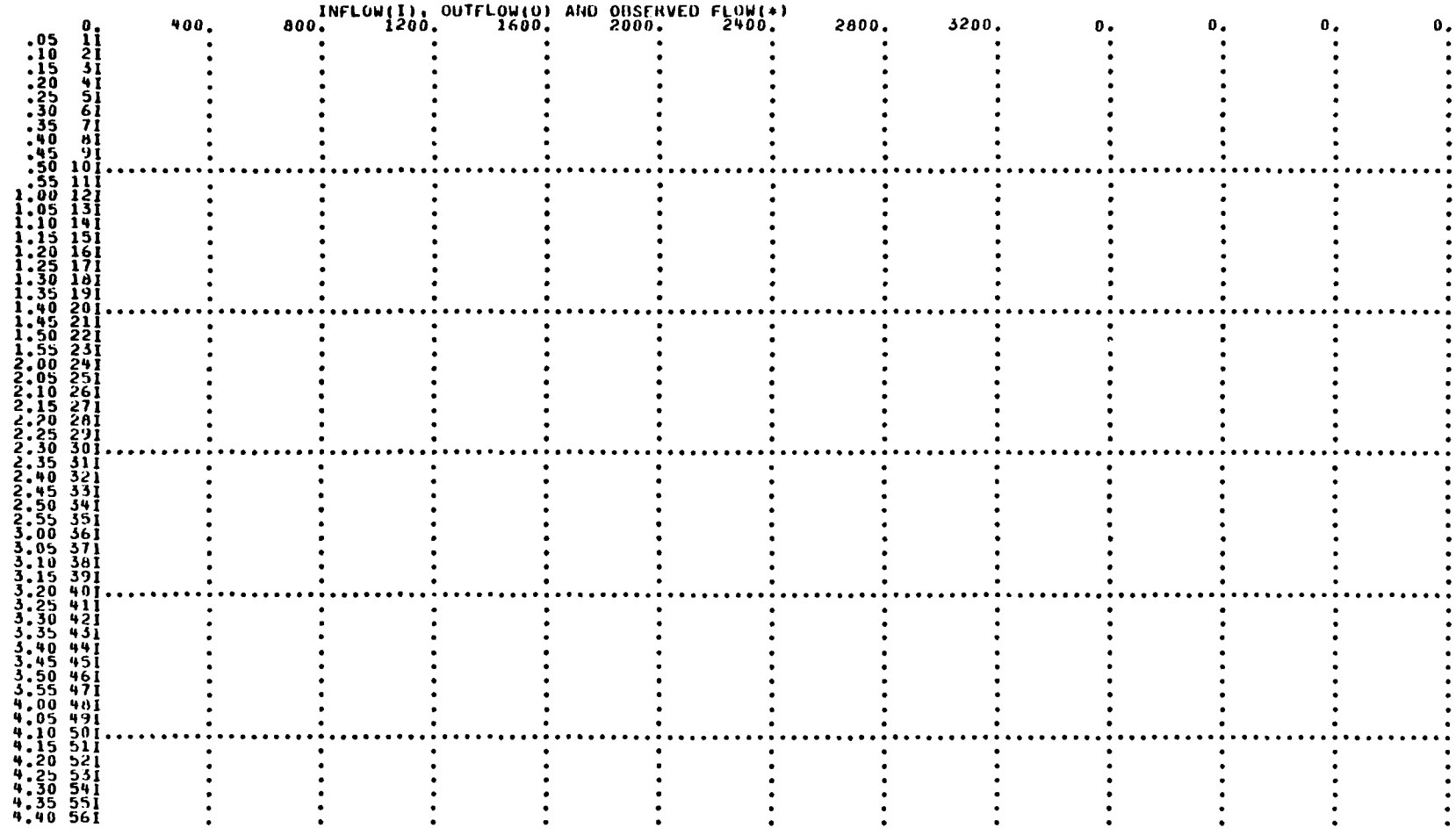


PLATE D-58


4.45 57I
4.50 58I
4.55 59I
5.00 60I
5.05 61I
5.10 62I
5.15 63I
5.20 64I
5.25 65I
5.30 66I
5.35 67I
5.40 68I
5.45 69I
5.50 70I
5.55 71I
6.00 72I
6.05 730I
6.10 740I
6.15 750I
6.20 760I
6.25 770 I
6.30 780 I
6.35 790 I
6.40 80.0I
6.45 81.0I
6.50 82.0I
6.55 83.0I
7.00 84.0I
7.05 85.0 I
7.10 86.0 I
7.15 87.0 I
7.20 88.0 I
7.25 89. 0I
7.30 90..0I
7.35 91. 0I
7.40 92. 0I
7.45 93. 0I
7.50 94. 0I
7.55 95. 0I
8.00 96. 0I
8.05 97. 0I
8.10 98. 0I
8.15 99. 0I
8.20100..0I
8.25101. 0I
8.30102. I
8.35103. I
8.40104. I
8.45105. I
8.50106. I
8.55107. I
9.00108. I
9.05109. I
9.10110..I
9.15111. I
9.20112. I
9.25113. I
9.30114. I
9.35115. I
9.40116. I
9.45117. I
9.50118. I

PLATE D-59

PLATE D-60

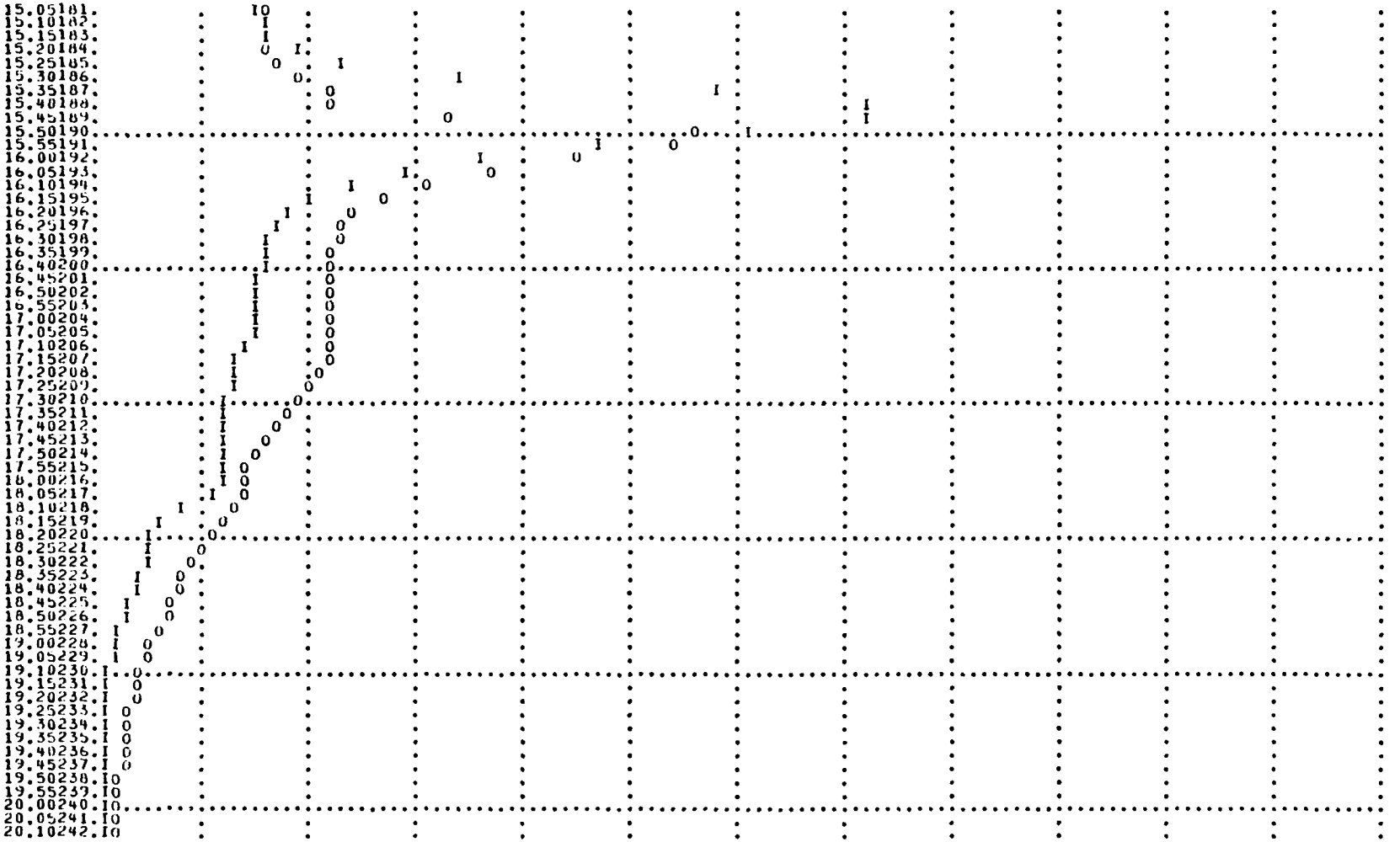


PLATE D-61

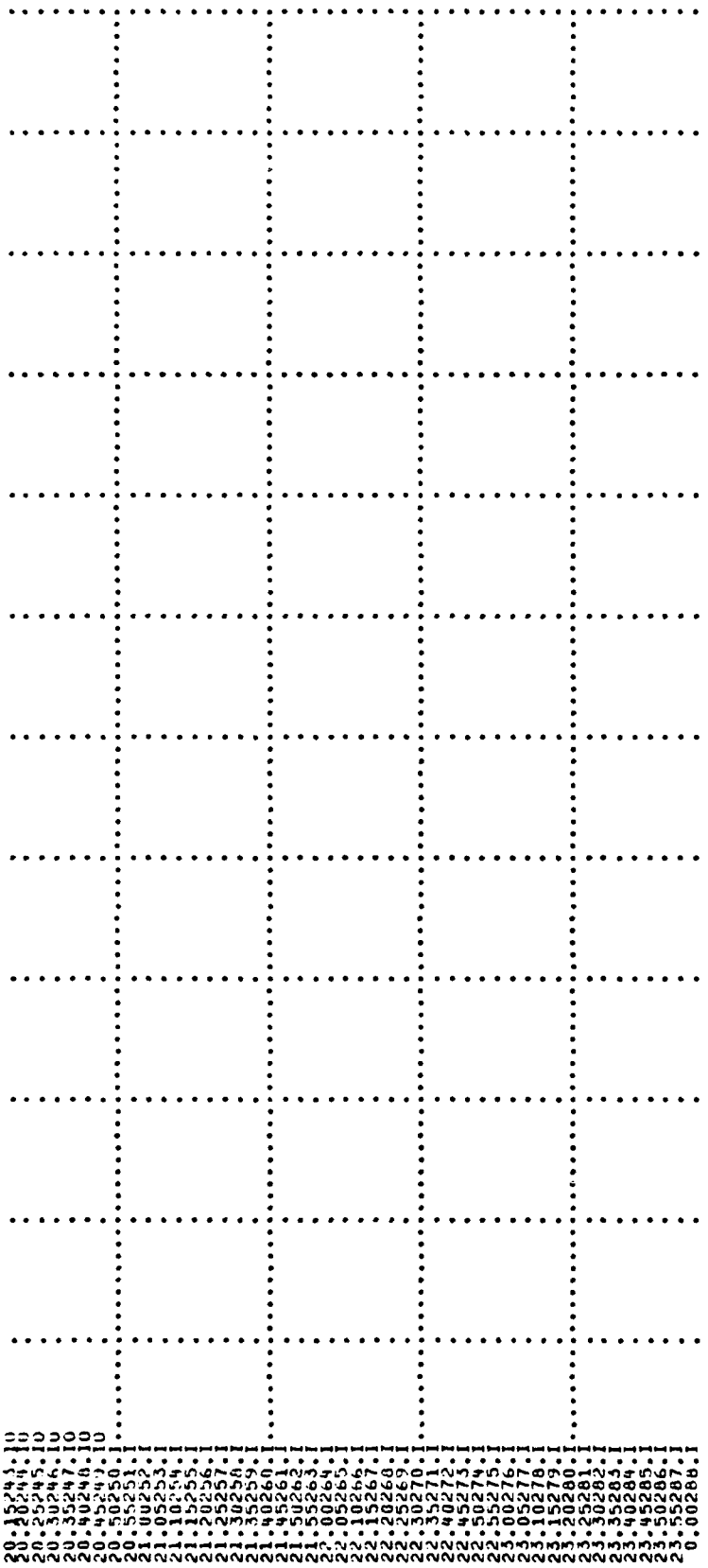


PLATE D-62

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .60	RATIO 3 .70	RATIO 4 .80	RATIO 5 .90	RATIO 6 1.00
HYDROGRAPH AT	000001	.21	1	1178.	1413.	1649.	1884.	2120.	2356.
		(.54)	(	33.35)(	40.02)(	46.69)(	53.36)(	60.03)(	66.70)(
ROUTED TO	000002	.21	1	1186.	1424.	1661.	1898.	2135.	2372.
		(.54)	(	33.58)(	40.31)(	47.03)(	53.74)(	60.45)(	67.17)(
HYDROGRAPH AT	000003	.06	1	458.	550.	641.	733.	824.	916.
		(.16)	(	12.97)(	15.56)(	18.15)(	20.75)(	23.34)(	25.93)(
2 COMBINED	M 2+3	.27	1	1435.	1726.	2019.	2313.	2606.	2899.
		(.70)	(	40.63)(	48.88)(	57.18)(	65.48)(	73.79)(	82.09)(
ROUTED TO	000004	.27	1	859.	881.	910.	1315.	1822.	2226.
		(.70)	(	24.31)(	24.96)(	25.77)(	37.23)(	51.59)(	63.04)(

PLATE D-63

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	779.00	776.30	782.60
STORAGE	1.	0.	7.
OUTFLOW	0.	0.	206.

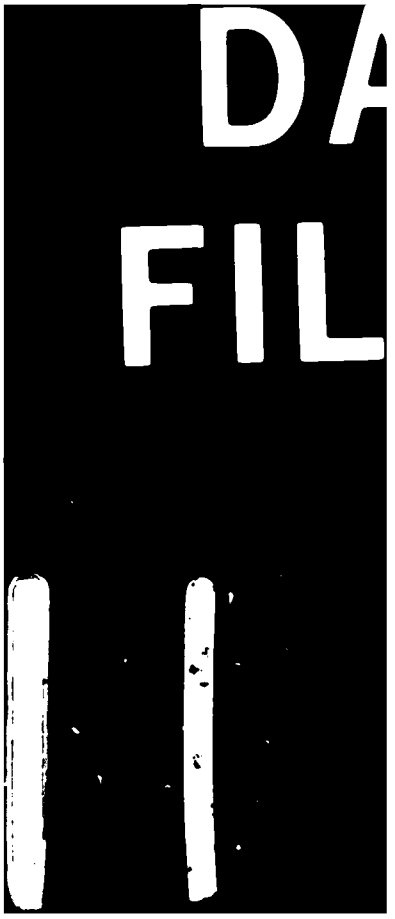
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	783.40	.80	9.	1186.	3.08	15.75	0.00
.60	783.50	.90	9.	1424.	4.67	15.75	0.00
.70	783.59	.99	10.	1661.	5.08	15.75	0.00
.80	783.67	1.07	10.	1898.	5.42	15.75	0.00
.90	783.75	1.15	10.	2135.	5.58	15.75	0.00
1.00	783.83	1.23	10.	2372.	5.75	15.75	0.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	779.00	779.10	785.40
STORAGE	42.	42.	103.
OUTFLOW	0.	0.	902.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	783.64	0.00	84.	859.	0.00	15.92	0.00
.60	784.56	0.00	94.	881.	0.00	16.00	0.00
.70	785.52	.12	104.	910.	.25	16.08	0.00
.80	786.10	.70	111.	1315.	.58	16.00	0.00
.90	786.43	1.03	114.	1822.	.75	15.92	0.00
1.00	786.64	1.24	117.	2226.	.75	15.83	0.00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